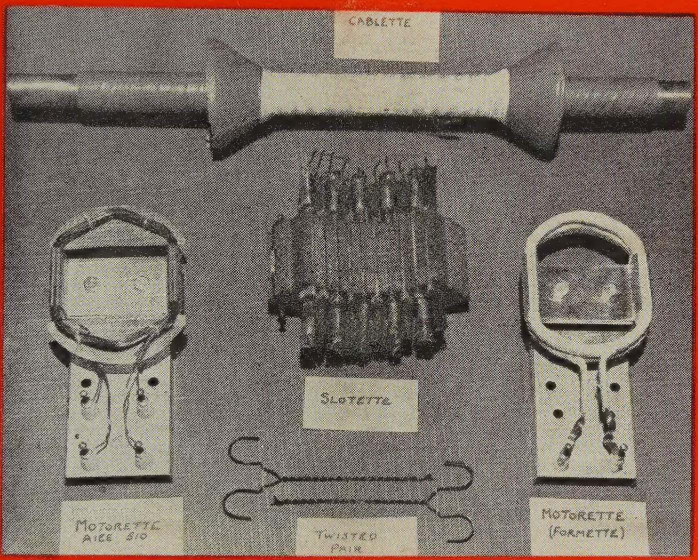
Permanent Reference

October 1960

Insulation



Selecting compatible materials . . . page 12

In this issue: *October insulation program . . . page 8*
Track-resistant coatings . . . page 20
Tandemized wire insulating . . . page 30
Moist conductors kill pain . . . page 36
Status of stators . . . page 38

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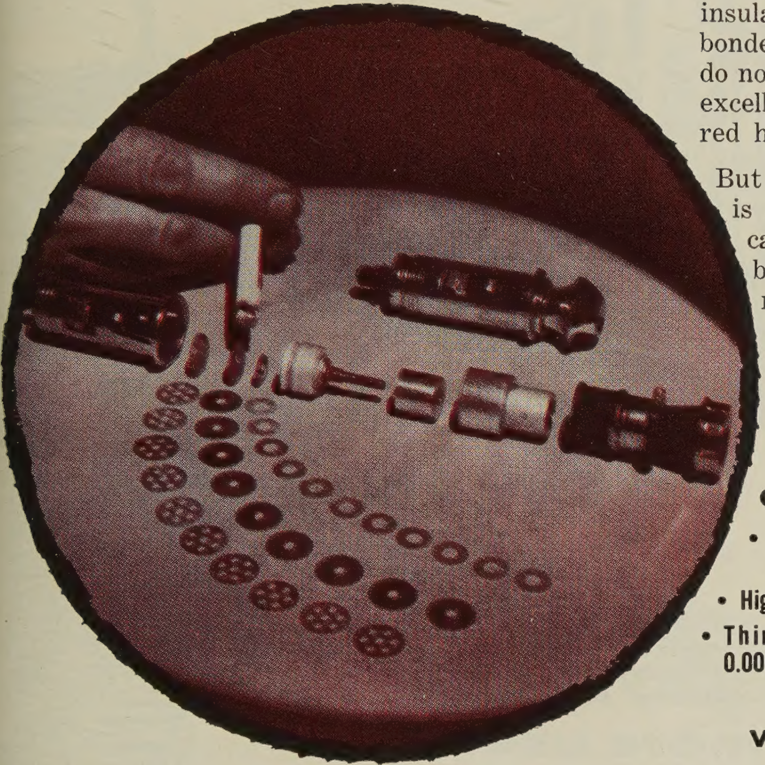

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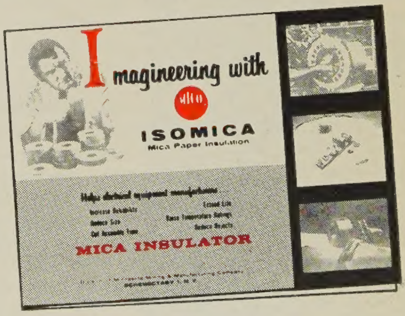

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Ave., Libertyville, Illinois, October 1960

8 *Conference on Electrical Insulation To Meet in Washington, October 17-19*

12 *Compatible Insulating Materials in Systems*
A. J. Sherburne

20 *Track-Resistant Coatings*
J. Chottiner and B. V. McBride

30 *Automatic Handling System For Wire Insulating and Sheathing*

54 *Close Tolerance Plastic Part*

54 *Polyethylene Packages Transformers*

55 *Printed Circuit Keys Automate Processes*

72 *Silicone Impregnated, Encapsulated Transformers*

74 *Nylon Jackets Airport Wire*

75 *Tiny Wafers for Microelectronics*

4 *From the Editor*

6 *News and Views*

34 *Industry News*

36 *Pixilated Patents*

38 *European Insulation Report*

42 *People in the News*

48 *Insulation Forum*

51 *Association News*

56 *New Products*

76 *New Publications*

78 *New Literature*

84 *Dates to Circle*

85 *NEMA Electrical Insulation Index*

86 *Advertisers' Index*

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Advertising Sales Offices: See page 86.

From the Editor

Opinions and Rambling Thoughts

NRC Insulation Conference

The complete program for the National Academy of Sciences-National Research Council Conference on Electrical Insulation appears in this issue. The conference is being held at the National Bureau of Standards, Washington, D.C., October 17 to 19.

Vice chairman S. I. Reynolds in charge of the conference program is to be congratulated on the impressive papers and authors he has assembled. Both theoretical and practical aspects of the insulation field are covered by the program so that the conference should be of interest to all scientific and engineering men in the field. We urge you to examine the program published in this issue and to plan to attend the conference.

As in past years, *Insulation* will present a comprehensive report on many of the papers presented at the conference on electrical insulation. This will appear in a future issue.

In this Issue

In this issue you'll find many interesting and helpful stories—both the regular editorial departments and special features.

"Compatible Insulating Materials in Systems," by Arthur Sherburne of General Electric Co., discusses the problems and complications involved when selecting insulation systems and effects on compatibility of materials in the systems. It also covers test methods for studying systems and compatibility, points out what can be done as far as classifying materials as to compatibility, and makes clear cut recommendations which should be helpful to any engineer concerned with insulation system design.

In this month's European Insulation Report, the European Editor reports on articles concerned with stator winding insulation which appeared in Europe. He then goes on to make an excellent case of presenting his personal opinions on this matter.

Two Westinghouse Electric Corp. men, G. Chottiner and B. V. McBride, have co-authored a very interesting article on track resistant coatings. Various test methods are described, a track resistant coating is evaluated, and procedures for applying such coatings are discussed.

Another article highlights the features and advantages of an automatic handling system for wire insulating and sheathing at Western Electric Co.'s new Omaha works. The system reportedly has contributed toward an equipment savings of $600,000.

Coming Up

There are important editorial plans shaping up for future issues too.

A supported silicone rubber tape development for the insulation of formed coils is covered in an article by T. G. Gair of the medium ac motor and generator department of General Electric Co. The article discusses the evaluation of a number of commercially avaliable materials and experimental products. Extensive data is presented.

The article "Epoxy Impregnation Replaces Casting for Components" by Henry Hirsch of General Precision Inc., discusses a dip method for simultaneously impregnating and encapsulating electronic components with epoxy resin. The processes are described and test results are presented. Better electrical performance and heat conductivity are the results reported.

Alfred G. Moreton, a consulting engineer with Pittsburgh Electrical Insulation Co., has prepared a story on banding armatures with polyester-glass tape. He discusses the necessary equipment, procedure, and calculations.

David M. Kelly with George C. Borthig C. Inc. has authored an article which gives a present day look at insulating varnish technology and "good housekeeping" practices.

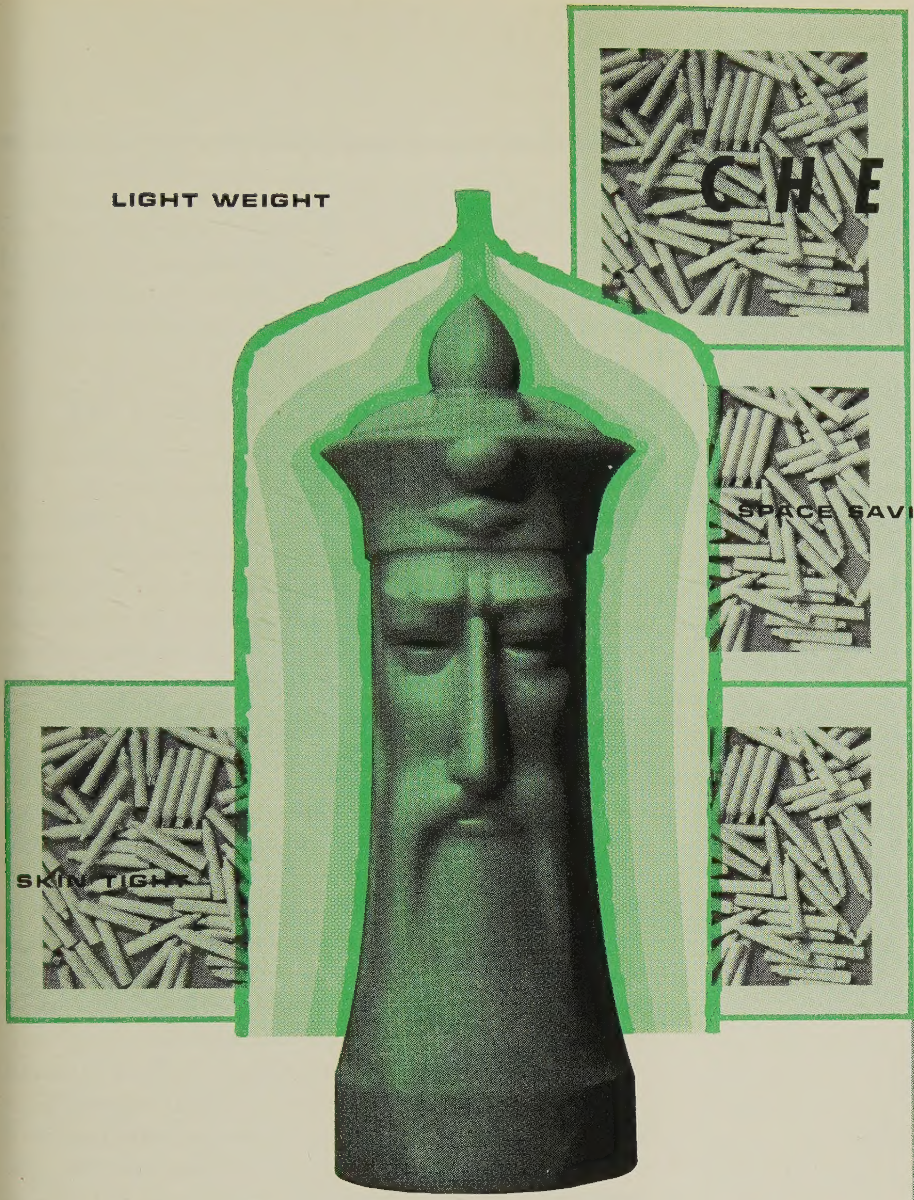
"The Climate for Invention" is an article which will be of interest to engineers, scientists, and management men both in and out of the insulation field. Prepared by W. H. Middendorf, associate professor of electrical engineering, University of Cincinnati and director of research, The Cincinnati Development & Mfg. Co., the article covers the need for ideas in industry, the kind of person who invents, the inventive process, methods to stimulate invention, fostering creativity, and inventiveness as applied to finding new insulation applications.

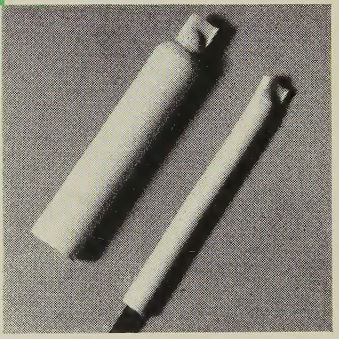
Another article with broad interest, "Aging Characteristics of Film Insulated Copper Wire in Transformer Oil," by G. F. Lipsey and P. W. Juneau of General Electric Co., covers a technique for evaluating wire enamels and total insulation systems for use in liquid immersed apparatus. Interesting conclusions are reached.

A report by M. F. McFadden of Raytheon Co. presents information on the extent to which plastics potting and casting processes are utilized in aero-space industries. The relative utlization of company formulated versus commercial ready-mix compounds is set forth and kinds of resins, fillers, and curing agents are tabulated.

"Rapid Identification of Magnet Wire Type by Reflectance Infrared Spectroscopy" is the title of another article by C. F. Hunt and A. H. Markhart of Shawinigan Resins Corp. The article describes the procedure and results obtainable with a method which has been used in the Shawinigan laboratory for some time for the rapid analysis of magnet wire coating on wire.

New developments in epoxy resins will be covered in a series of six articles starting soon. The series will bring the complete subject of epoxies up to date. The articles are written from the viewpoint of the polymer chemists working in the field of electrical insulation. The text will be readable and comprehensible to the electrical engineer as well as to all others. The series is prepared by members of The Epoxylite Corp. research staff and other experts.





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News and Views

Polyethylene News

Union Carbide Plastics Co. has reduced its prices on low-density polyethylene. Reductions range up to five cents per pound and apply to practically all types of "Bakelite" brand low-density polyethylene resins and compounds. Since 1943 the price of polyethylene resin has been reduced over 70%.

With a new section of the U. S. Industrial Chemicals Co.'s polyethylene production plant at Houston, Texas, which has just gone on-stream, capacity of the plant reportedly has doubled. The new installation establishes U.S.I. as the second largest producer of polyethylene in the world according to Dr. R. E. Hulse, executive vice president of National Distillers and Chemical Corp. and general manager of the U.S.I. Div. U.S.I.'s total production capacity of "Petrothene" low and medium density polyethylene resin now stands at 300-million pounds per year. All this has been accomplished in the space of five years—the first U.S.I. plant with a 25-million pound annual capacity came on-stream at Tuscola, Ill., in 1955.

Taylor Fibre Acquires Dytronics

Taylor Fibre Co., Norristown, Pa., manufacturer of laminated plastics and vulcanized fibre, has acquired Dytronics Inc., Rochester, Mich. manufacturer of die-stamped circuits. The purchase is being accomplished through an exchange of stock. Taylor plans to operate Dytronics as a subsidiary at its present location with its present officers and employees. Taylor has been an important supplier of copper-clad laminates to the 50-million dollar printed circuit industry. Through Dytronics, a two year old firm, it now will be able to offer die-stamped circuits which are made by embossing adhesive coated copper on the laminated plastic base. Dytronics is the first company purchased by Taylor. According to Edward H. Da Costa, vice president, marketing, the move is part of a planned diversification program directed toward the production and sale of more end products using laminated plastics and vulcanized fibre.

Simplex and Hitemp Plan Merger

The directors of Simplex Wire & Cable Co., Cambridge, Mass. and Hitemp Wires Inc., Westbury, L.I., N.Y., have approved a merger plan for submission to stockholders which will merge Hitemp into Simplex. It provides for an exchange of one share of Simplex stock for two shares of Hitemp. Simplex, with about 1500 employees, has manufactured insulated wires and cables for power transmission, communication, control and signaling purposes since 1885. Hitemp, with about 300 employees and organized in 1951, manufactures high temperature insulated wires and cables for missiles, electronics, and business machines. Plans call for the operation of Hitemp as a division of Simplex.

Goodrich Enters ABS Plastics Field

B. F. Goodrich Chemical Co., Cleveland, has announced its entry into the ABS materials market with a family of products to be known as "Abson" resins and compounds. ABS materials, acrylonitrile-butadiene-styrene polymers, are thermoplastics with high impact strength suitable for processing on conventional extrusion, calendering, and injection molding equipment. Goodrich, together with its overseas associate companies, is the largest producer of vinyl resins in the world.

Insulation Application Conference News

Final plans and arrangements for the Third National Conference on the Application of Electrical Insulation continue to move along smoothly. The meeting will be held at the Conrad Hilton Hotel in Chicago, December 5 to 8. Arrangements have been made for more extensive plant tours than in previous years. Conference registrants will be able to visit plants manufacturing both light and heavy electrical equipment and electronic products.

Arnold Bohn, Dow Corning Corp., conference exhibit chairman, reports that a number of exhibit booths have been sold since the last listing of exhibitors was published in the September issue of *Insulation.* New exhibitors not previously reported include Belden Mfg. Co., The Border Chemical Co., Electronic Mechanics Inc., Industrial Instruments Inc., Jordan Mfg. Co., Rostone Corp., Electro Technical Products Div., Sun Chemical Corp., and The Zippertubing Co. In addition, a number of exhibit space applications are presently being processed. A few spaces remain for last minute exhibitors.

Technical program papers which were not included in the listing which appeared in last month's issue include Class F Systems for Medium-Size Rotating Equipment by Henry Pollack of Ingersoll Rand Corp., Laboratory Evaluation of High Voltage Stator Insulation by P. E. Podhore of General Electric Co., The Evaluation of Thermal Endurance of Rigid Electrical Insulation by K. Wechsler of Westinghouse Electric Corp., Glass-Epoxy Laminates by D. Ronay of The Richardson Co., Environmental Protection by K. Mills of The Martin Co., Component Design for High Temperature Equipment by L. F. Kilham of Raytheon Co., and Encapsulation of Electrical Components Using Heat Shrinkable, Pre-Molded Parts by P. M Cook, V. L. Lanza, and J. S. Conde of Rayclad Tubes Inc

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Conference on Electrical Insulation To Meet in Washington, October 17-19

The annual meeting of the Conference on Electrical Insulation for 1960 will be held at the National Bureau of Standards, Washington, D. C., October 17-19. Hotel reservations should be made at the Shoreham Hotel, 2500 Calvert St., N. W., Washington 8, D. C.

There will be 27 technical papers presented. Each will be limited to 20 minutes, with 15 to 17 minutes devoted to the actual presentation and 3 to 5 minutes allowed for discussion.

Members of the conference receive the Annual Report of the Conference and the Annual Digest of the Literature on Dielectrics for the combined registration and membership fee which has been increased to $10 this year. The registration fee for nonmembers is $5 and does not include publications. Students will not be required to pay the registration fee and may purchase the publication at a discount.

Registration for the conference will begin at 4 pm Sunday, October 16.

The Executive Committee will meet on Sunday evening. For information, contact Philip Franklin, Diamond Ordnance Fuze Laboratory.

The conference will be opened at 8:50 Monday morning, October 17, by W. M. McMahon, Bell Telephone Laboratories, chairman of the conference. S. I. Reynolds, General Electric Co., is vice chairman, and Philip Franklin, Diamond Ordnance Fuze Laboratory, is secretary. At 11 am, Professor Arthur R. von Hippel, Massachusetts Institute of Technology, will deliver the annual J. B. Whitehead Memorial Lecture.

There will be a separate luncheon meeting for the Digest Committee at 12:30 on Monday.

The annual business meeting of the conference will begin at 2 pm Tuesday. There will be a discussion regarding the conference organization, new officers will be nominated, and a meeting place for 1962 will be selected.

The annual Conference banquet will begin at 7 pm on Tuesday evening. Dr. R. D. Huntoon, Deputy Director, National Bureau of Standards, will be the speaker. His subject will be announced at the meeting.

The conference will close at noon on Wednesday, October 19, to allow attendees an opportunity to catch afternoon planes home.

Program

Twenty-Ninth Annual Meeting

Conference on Electrical Insulation

of the

Division of Engineering and Industrial Research
National Academy of Sciences-National Research Council

October 17-19, 1960

National Bureau of Standards
Washington, D. C.

Monday—October 17

8:30 am—Registration

8:50—Opening of the Conference, by W. M. McMahon, Chairman of the Conference.

9:00—An Ultra-Low Frequency Bridge for Dielectric Measurements, by D. J. Scheiber, National Bureau of Standards.

9:20—Residual Losses in a Guard-Ring Micrometer-Electrode Holder for Solid-Disk Dielectric Specimens, by Arnold H. Scott and William P. Harris, National Bureau of Standards.

9:40—Measurement of Dielectric Constant and Dissipation Factor Without Attached Electrodes, by H. S. Endicott and E. J. McGowan, General Electric Co.

10:00—Some Novel Resonant Cavity Techniques for the Evaluation of Artificial Dielectrics, by D. Edelson, W. A. Yager, and W. McMahon, Bell Telephone Laboratories Inc.

10:20—A Liquid Displacement Test Method for Determining the Anisotropic Dielectric Properties of Printed Wiring Boards, by Kenneth G. Coutlee, Bell Telephone Laboratories Inc.

10:40—Intermission.

10:50—Remarks by K. N. Mathes, General Electric Co., on Whitehead Award.

11:00—J. B. Whitehead Memorial Lecture, by Professor Arthur R. von Hippel, Massachusetts Institute of Technology.

12:30 pm—Luncheon Meeting of the Digest Committee.

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Natvar Teraglas will prove advantageous in many applications — for insulating motors, generators, transformers, cables, switchgear, busbars, and other apparatus and equipment where resiliency and high dielectric strength are desirable.

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Physical Properties:		.008"	.010"	.012"	.015"
Approx. weight lbs./sq. yd.		0.43	0.54	0.62	0.77
Breaking Strength lbs./in. width	Warp	45	45	45	45
	Filler	100	100	100	100
Tear Strength, grams	Warp	1000+	1000+	1000+	1000+
	Filler	1000+	1000+	1000+	1000+
Elongation, % (Under 25 lbs./in. width —3 minutes)		9.5	7.5	7.5	7.0

Electrical Properties:	.008"	.010"	.012"	.015"
Elec. Breakdown Strength (C48-23-50 V/M)	1600	1600	1600	1600
Elec. Breakdown Strength (Under 6% stretch)	1600	1600	1600	1500
Elec. Breakdown Strength (Under 12% stretch)	1500	1450	1450	1300
Power Factor, %, at 80° C-50 V/M-60 c.p.s.	2.2	2.5	2.5	3.0

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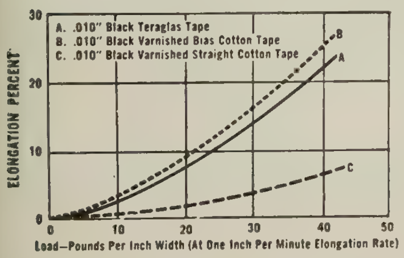

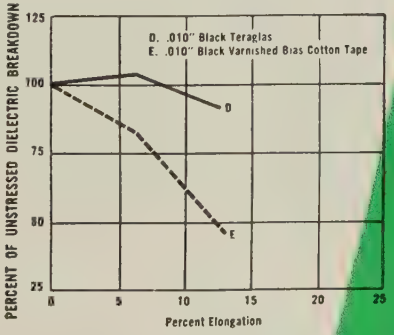

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2:00—Townsend Ionization Constants in n-Alkanes, by O. H. LeBlanc Jr. and J. C. Devins, General Electric Research Laboratory.

2:20—On the Electric Strength of Gases at Elevated Pressures. III. Hexane, by A. H. Sharbaugh and P. K. Watson, General Electric Research Laboratory.

2:40—Electric Breakdown in n-Hexane, by A. M. Sletten, Westinghouse Research Laboratories.

3:00—Electric Breakdown in Rutile Single Crystals, by Dean A. Powers, Massachusetts Institute of Technology, and Prof. Inge Johansen, Norges Tekniske Hgskole.

3:20—Analysis of the D-C Breakdown in Sintered Titanates, by W. Tantraporn, National Bureau of Standards.

3:45—Round Table Discussions.
Dielectric Breakdown—Gases, Liquids, Solids.
Fundamental Aspects of New Dielectric Liquids.

Tuesday—October 18

9:00 am—Reactions of Active Nitrogen with Polyethylene, by J. L. Weininger, General Electric Research Laboratory.

9:20—Effects of Corona on Vinyl Tapes, by Murray Olyphant Jr., Minnesota Mining and Mfg. Co.

9:40—The Gassing Properties of Pure Aromatic Hydrocarbons under Electrical Stress, by Walter F. Olds and George Feick, Arthur D. Little Inc., and Edward D. Eich, Anaconda Wire and Cable Co.

10:00—Intermission

10:20—Electrical Surface Failure in the Presence of Conducting Liquid Contaminant, by E. J. McGowan and K. N. Mathes, General Electric Co.

10:40—Electrical Tracking Resistance of Polymers, by G. Sommerman, Westinghouse Research Laboratories.

11:00—The Effects of Electrical Discharges on Solid Insulation. II. Discharges Occurring in Static Air, by L. Mandelcorn, R. E. Hoff, and G. R. Sprengling, Westinghouse Electric Corp.

11:20—Studies on the Thermal Degradation Elevator Effect, by Roy R. Divis, Amphenol-Borg Electronics Corp.

Lunch

2:00 pm—Annual Business Meeting of the Conference.

3:00—Gamma Radiation Induced Conductivity in Solid Insulation, by Dr. Vaughn Culler and W. H. Barney, Corning Glass Works.

3:20—Radiation Degradation of Polyester Film and Polyvinyl Film, by L. M. Epstein, Westinghouse Research Laboratories.

3:40—Theoretical Limitations on the Properties of Dielectric Liquids. I. Dielectric Constant and Electrical Loss, by Donald Tuomi, Thomas A. Edison Research Lab.

4:15—Round Table Discussions.
Electrical Discharges on Insulation.
Fundamental Aspects of New Solid Dielectric Materials.

7:00—Conference Banquet, Dr. R. D. Huntoon, Speaker (subject to be announced), Deputy Director, National Bureau of Standards.

Wednesday—October 19

9:00 am—The Electrical Properties of Some Bicyclic Nitriles, by R. W. Tucker, Diamond Ordnance Fuze Laboratories.

9:20—Dielectric Properties of Glasses, by Chidara Hirayama and Daniel Berg, Westinghouse Research Laboratories.

9:40—The Electrical Properties of Some Solid Organic Esters, by Ann M. Parks, International Business Machines Corp.

10:00—Intermission.

10:20—The Hygroexpansivity of Cellulose Papers, by T. D. Callinan, J. S. Crimi, P. Schwarz, and L. H. Wirtz, International Business Machines Corp.

10:40—The Theory of Loaded Foam Dielectrics, by W. A. Yager, D. Edelson, and W. McMahon, Bell Telephone Labs. Inc.

11:00—Variation of the Electrical Length of Coaxial Transmission Lines with Temperature, by J. Arbuthnoot Jr., R. J. Gehm, and J. J. Nevin, Phelps-Dodge Corp.

11:20—The Influence of Metallic Fillers on Epoxy Plastics, by John Delmonte, Furane Plastics Inc.

11:40—Closing of the Conference, by W. McMahon, Chairman of the Conference.

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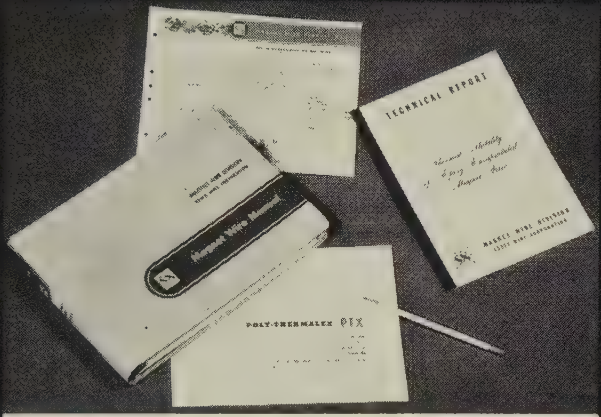

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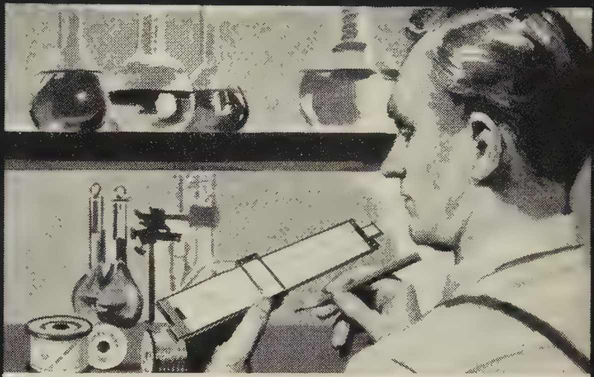

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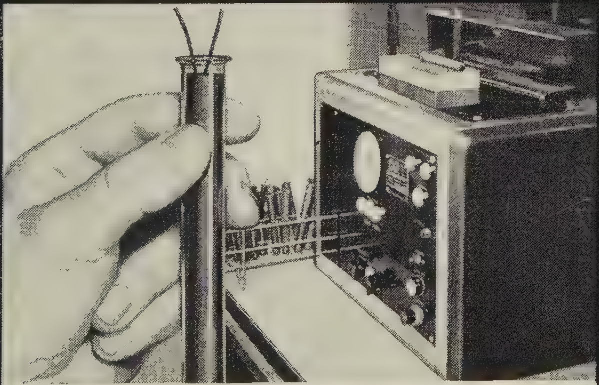

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Compatible Insulating Materials in Systems

By A. J. Sherburne, Insulating Materials Department, Insulation Application Center, General Electric Co.

The proper selection of the best insulating materials or combinations of materials to meet the requirements of a specific duty or service application is becoming more difficult. This is because of several factors such as the increasing variety of new products available, the trend to higher temperature operations, and the trend to sealed constructions and changes in application methods and processes. It is understandable that there is a natural desire for better materials at lower cost, making choice of materials increasingly more complicated.

More and better information is required, not only on the properties of each of the materials, but also (and of even greater importance) on these materials when used in combinations required for the insulation system used in the specific type of electrical equipment under consideration.

In the last few years, enough emphasis has been placed upon the importance of systems and of functional tests simulating actual use so that very little more need be said in defense of the systems idea. Much activity in the design and evaluation of new test procedures of this nature is evidenced by the large number of technical papers presented in the last eight or ten years on this subject. Much of this activity is being reported by ASTM and AIEE working groups on evaluation of test methods, especially in the field of thermal endurance and temperature life.

The terms "system" and "compatible" refer to concepts that have been with us always, but because of the trends mentioned in the first paragraph as well as other factors, these terms have now taken on new importance and new meaning. They have been given more and more attention because of cost reduction goals to be gained by the use of thinner insulation, by reductions in size and weight, and by new techniques.

It is very rare that just one material is used alone as an insulation system. In most electrical machinery, even the simplest, at least three types of materials are used (wire, varnish, and ground insulation). Any such combination of material is called an insulation system. By now, it is well established that the properties of a system are not a simple sum of the properties of all its parts. Wherever possible, the best system to have is the one where the expected performance is better than that of any part.

An insulation system may be considered as any combination of two or more insulating materials used together in the construction of a piece of electrical apparatus. The simplest examples are combinations of enameled wire and varnish in a coil; of varnished cloth and a covering or braid in a cable; and of oil and paper in large power cable, bus bar insulation and many others. More complex systems are combinations of several materials used in rotating machinery, transformers, switchgear, and controls. While the components of any system are usually insulating materials, there may be essential components which are included solely for assembly or mechanical reasons where electrical properties are of minor importance. The designer of today must know more about materials than previously because he is trying to use these materials closer to their capabilities in his apparatus designs. He aims to make more efficient use of newer materials by using them at their optimum properties, with a more daring factor of safety.

Properties of the System

Not only must the electrical, physical and chemical properties of each material used in the system be known, but also their combined properties when a part of a system. These properties can be quite different. Two materials, although each has satisfactory properties "on paper," will not necessarily perform as expected when combined. They may work *against* each other. On the other hand, by careful selection of material combinations, the resultant properties of a finished system may be more than additive. That is, the system may perform better than the properties of the individual components would indicate.

The best combination can only be found by test and experience and will be different for different types of equipment. It may even be quite different within one line of apparatus, depending on size, temperature rating, and service requirements or design.

Compatibility

The concept of compatibility has been recognized since the earliest days of the electrical industry. The word "compatibility" implies that one material has no adverse effect on the key properties of another and on the final properties of the system. The trend to "more power at less cost" coupled with the great increase in availability of materials of widely different properties, especially at higher temperatures, has made the problem of compatibility much more acute.

Early in electrical industry history, problems of incompatibility were apparent. Many materials and processes which to our eyes would seem horrifying were used successfully in spite of high acidity of varnishes, wide use of moisture-susceptible cellulosic materials such as paper and cotton, and lengthy treating and curing cycles exposing windings to wet, uncured varnish for long periods of time. Oxidation reactions which were accelerated by the driers used led to limited short life at service temperatures much lower than those expected of present day equipment.

AIEE No. 1 was undoubtedly solidly based on service experience when first issued. As new materials were developed, especially resins and varnishes, it took a long time for engineers to realize that they were using new materials which made the original temperature classification very, very conservative, to say the least.

All common insulation systems still have a large organic content but the old ideas of rapid thermal degradation being inevitable at any temperature above 105°C have been considerably modified and insulation engineers have raised their sights 50° to 100°. Properties, with few exceptions, do deteriorate with temperature, aided and abetted by chemical and mechanical incompatibilities and involving changes brought on by oxidation, depolymerization, moisture, plastic flow, corona, radiation, etc. It is a surprising fact that the 10° rule of chemical reaction rates seems to hold so well for the thermal endurance of so many insulation systems—a fortuitous circumstance considering the heterogeneous nature of the systems.

We have defined compatible materials used in systems as those which may be applied, baked, cured, or processed without harming or attacking each other or developing structural or electrical weaknesses leading to premature failure in service.

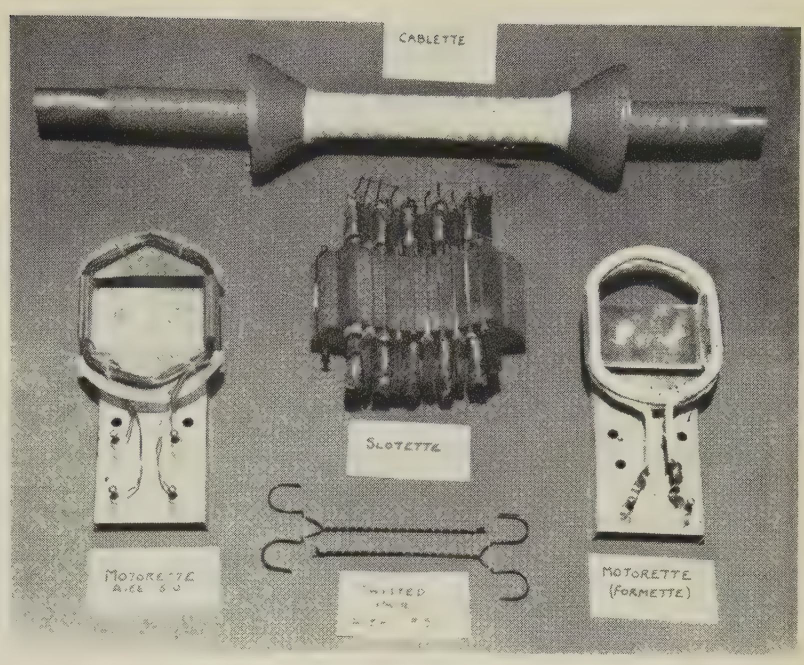

Figure 1, test devices used in procedures to evaluate insulation systems at the General Electric Insulation Application Center. Displayed are the cablette, slotette, motorette, formette, and twisted pair.

Incompatibility

Examples of incompatibility in the past were:

1. Magnet wire made with oleoresinous enamel and varnishes containing strong solvents. Not only were varnish solvents severely restricted to petroleum hydrocarbons, but cotton and paper were used as a covering to protect the enamel from mechanical damage.
2. Because so much cellulose (paper and cotton) was used, there was a great reluctance to bake equipment above 105°C in spite of the demonstrations by a few pioneers that better results could be obtained in shorter times at higher temperatures without any significant deterioration of the cellulose protected from the air by the varnish. While some progress was being made in this area, it was the advent of "Formvar" enamels and glass fiber cloths and tapes with the consequent elimination of much of the paper and cotton that permitted a universal swing to much higher baking temperatures and greatly improved insulation systems.

Choice of materials became a greater and greater problem because of the phenomenal growth of the synthetic resin industry and the tremendous variety of materials made available. The work of screening all these materials was, in itself, an undertaking of magnitude. In the past, the electrical designer availed himself of any existing varnish, coating, or sheet material which might be used as an insulating material. However, more recently the engineer and the chemist have worked more closely together to design materials to meet design needs. Progress has been a kind of zig-zag forward motion by the engineers and the chemists but plainly showing higher and higher frequency of zig-zagging along with an accelerated forward travel. The engineer has to meet greatly increased performance characteristics for his equipment—more reliable performance, at higher temperatures, under more severe environments, always with the cost dollar sign hovering over his head as a guardian angel. He has been known as an ultra-conservative who overdesigned his equipment to be sure and thus tempted the user to greatly overload his equipment to get more power at low additional cost.

Both world wars gave great impetus to new looks at redesign and more realistic use of materials. This has accelerated the design of electrical equipment involving new insulation systems. The net result is the very worthwhile objective of using these insulation systems at or under conditions closer to their capabilities but their capabilities can only be gauged by test or experience.

In order to do this, a more quantitative approach to the study and evaluation of materials and systems has been required. The trends in design are closely tied in with material improvements and developments. New test methods have had to be devised. The value of functional tests and tests on simulated structures as accelerated life tests has been recognized. No voice would now be raised against the premise that material property tests are insufficient, nor against the evaluation of all candidate materials by a suitable test model designed to simulate as far as practical actual use on some broad type of apparatus.

Improved Test Methods for Study of Systems and Compatibility

Probably the simplest functional test is the twisted pair using AIEE procedure #57. This has already proven to be a valuable tool for screening a large number of enameled wire and wire and varnish systems. Even though end-points of thermal life have not been officially established, and there are discrepancies in

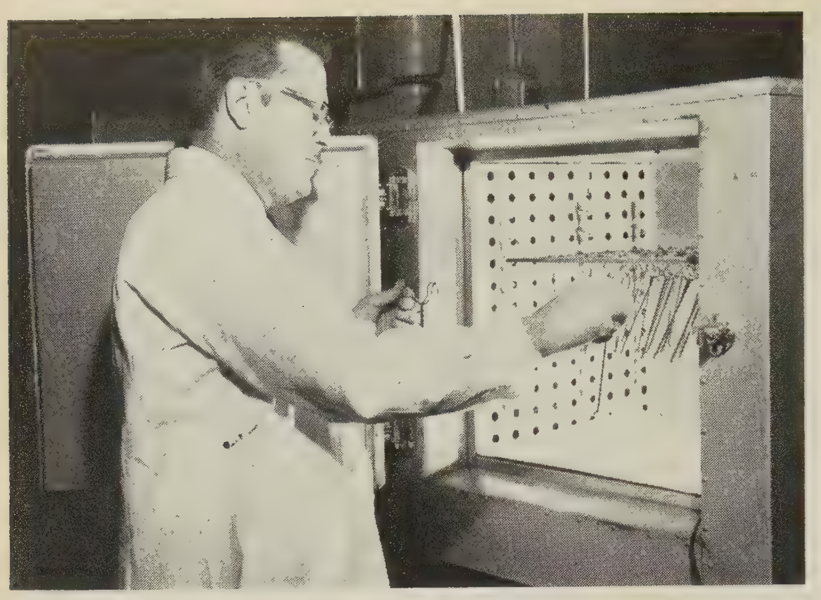

Figure 2, high-temperature (up to 250°C) life-testing of twisted pairs of enameled magnet wire at the G-E Insulation Application Center.

test results from different laboratories due to little differences of individual techniques, the data accumulated is quite considerable. Fortunately, in many cases they do parallel service experience and results by other important procedures such as those on motorettes and motors in AIEE #510.

The twisted pair is valuable for determining life, temperature rating, and compatibility of enamel, varnish, solvents, accelerators, retarders, and catalysts. With some modification, it can be a measure of cure in deep sections and of incompatibilities such as attack on enamel under most severe embedded or encapsulated conditions. With further modification, it can be used as a rough measure of three-part systems of enameled wire, varnish, and coil wrapper or tape as ground insulation, but here the motorette, formette, and other models seem to be more satisfactory.

Motorettes using #510 procedure have also been firmly established as a reliable functional test for more elaborate insulation systems simulating construction of a random wound motor. Although here again the AIEE working committee has accumulated a vast amount of data, there are still variations in different laboratory techniques which give a wide spread of values. Because of this, at the present, no one is quite ready to agree as to the proper extrapolated end-point, though such agreement appears quite close.

Spread of Life Expectancy

It is the experience of the General Electrical Insulation Application Center laboratory that results on aging at the different temperatures with an occasional exception are well within the envelope of 95% confidence boundaries. This has led us to feel that with the majority of systems now being studied, there is little need to go to the elaborate probability calculations which may be necessary only with an entirely new system, to establish a basis for evaluation.

It is felt that the individual life results with the motorette or the twisted pair are closer together than one can ever expect from actual service life of the equipment. In other words, the spread of life expectancy for a thousand motors in the field can be much wider than the spread of test results by these procedures.

Warnings as to the dangers of extrapolation and of doing tests at excessively high temperatures where different reaction rates or deterioration factors may occur, have been made by the various study groups and should be heeded. It is very desirable to set limits on the minimum number of hours life at the higher temperatures and to watch life data at these higher temperatures to detect any marked change in rate shown by a break in the curve of sufficient magnitude to move the extrapolated life out of one class into another.

No one test gives all the answers. Certainly the twisted pair and the motorette are much more reliable and realistic than the old method of oven aging of films of varnish on copper and of coated fabrics and the 1/8" mandrel test. For aging and thermal life, we have in procedures #57 and #510 two excellent methods of test. Only minor details to insure greater correlation between laboratories remain to be worked out at present.

While thermal aging has been given the major attention because it is the number one deterioration factor in insulation life and performance, there are other properties beyond thermal life and moisture resistance. Until recently, there has been very little information available on the behavior and properties of systems at operating temperatures.

There are several potentially good bonding tests—splint tests which can be performed at elevated temperatures. These are reproducible tests for varnish wire systems and can be used to a limited extent to measure incompatibility. These, plus armature spin tests together with the twisted pair and motorettes, can give a very good evaluation of systems for random wound rotating low voltage machinery.

Slot Insulation

The component not completely evaluated by these tests is the slot insulation. Here we are interested not only in thermal life but in some very important mechanical properties necessary both for assembly in manufacture and in service. First and foremost, there is *conformity to the slo* which according to the shape of the slot—round or square—may mea ability to withstand spring-back on the one hand or sharp corner bending on the other.

Work has been going on in severa laboratories on means of measuring these properties as well as cut-through cuffability, and delamination. In ou laboratory, we are collecting wha looks like useful data on the therma life of slot insulation in what we wil call a "slotette" in which the slot insu ation is inserted in dummy slots and a bundle of random wound wires inserted. The unit is then varnish treated, aged, and cycled in a procedure similar to AIEE #510. The interest here is primarily in the ultimate failure to ground of the slot insulation. This work will be reported in a forthcoming paper at the December meeting of the National Conference on the Application of Electrical Insulation.

Form Windings

What about form windings? AIEE #511 having been shelved, we are going ahead with a modification of the motorette using rectangular wire and typical form wound coil constructions to determine if such a simplification can give significant data on form wound coil insulation systems. As this work is only beginning, no predictions of its results can be made at this time, but the work will also be described at the December meeting.

Voltage Endurance Tests

Meanwhile, there are several voltage endurance tests of proven reliability and usefulness. The main disadvantage to voltage endurance tests at high voltages is the great length of time needed for breakdown of the elaborate constructions of the bars or "cablettes" to prevent flashovers. However, data of this kind has been and is being collected by our Insulation Application Center, as well as others.

New and quicker measurements of voltage endurance have been described by Rhudy and Mazanek in AIEE paper #58-1391 in which breakdown is speeded up by using higher frequency than 60 cycles.

Can Materials be Classified As Compatible?

Enough is known about polymer chemistry today that it should be possible to predict with reasonable accuracy whether different materials in a system will be compatible when completely cured or processed correctly. These two conditions, however, are not strictly predictable for each individual case. Whereas it may be possible to say broadly, for example, that epoxies and phenolics are compatible, there can be greater variations within each of these groups in degree of cure, kind of catalyst, solvent, or process details that make it very difficult to state with absolute certainty that one class of materials is compatible across the board with another. Only by test of specific systems can this be more completely determined.

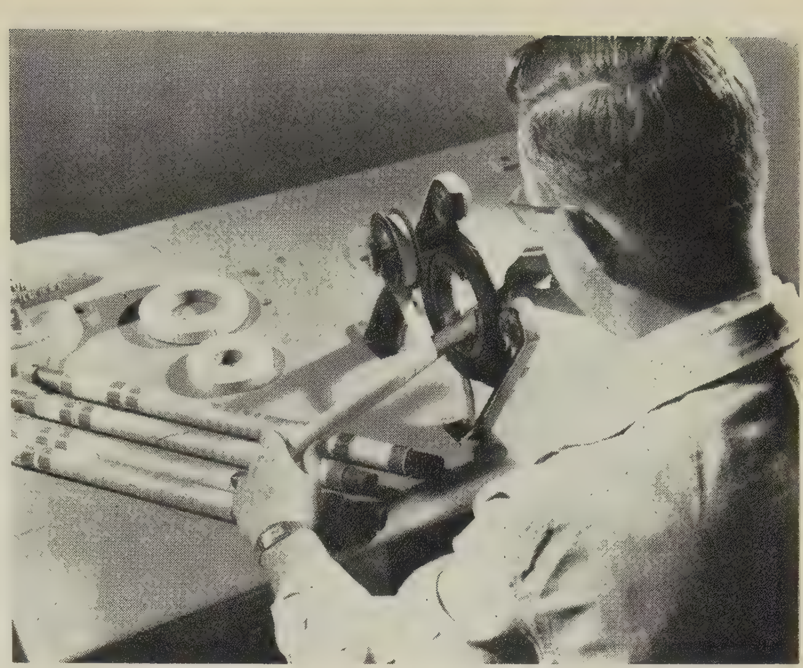

Figure 3, tapeability trials at the G-E Insulation Application Center determine physical qualities of cable cloths on cablettes.

With varnish and resin treatments, we have a situation quite different than with any other insulation material used in a system. These materials are applied as uncured A stage materials and often are processed only to a B stage in manufacture. They often reach the final stage of cure only in service. With many varnishes this leads to no trouble, as years of experience have shown. If the material is advanced far enough to pass manufacturing tests, it can be expected to actually improve in service over a considerable period of time. On the other hand, especially with catalyzed and accelerated polymers, there may be serious softening of enamel on wire, or formation of breakdown products which cause failure under high heat or moisture conditions in service.

Can Systems be Classified As to Compatibility?

The great interest in systems evaluation and in the development of new test procedures in the last few years is already bearing rich fruit in reliable information on compatible insulation systems which lead to improved designs and new insulation practices. It has become possible to use many new materials and systems at a much lower factor of safety, determined not by being cautious but by reliable test data as to safe limits of performance in systems. While the ultimate value of any insulation system is determined in service on the equipment for which it was designed, the investigations now going on and those to come are developing accelerated tests which will give adequate reliable predictions of minimum and average behavior of the many new materials and systems.

We have defined compatible materials as those which may be applied, baked, cured, and then operated under normal conditions in our insulation system without any of the materials harming or attacking any of the other materials in a manner which will cause a premature insulation failure.

Fortunately more systems are compatible than not, but conditions of service and manufacture have been changing rapidly. Some materials are very old in insulation history yet are still satisfactory in many applica-

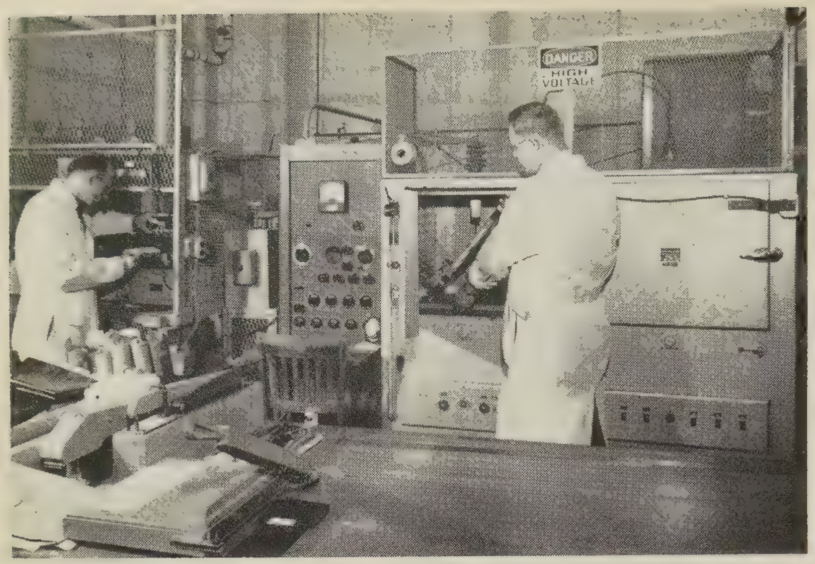

Figure 4, power factor tests on cablettes at the G-E Insulation Application Center laboratory.

tions. This is partly because of the over-design safety factor originally employed and already mentioned. The materials have enough reserve to perform adequately even under much more severe application.

It should be possible to recommend complete systems for certain types of equipment with some assurance based on results of these new test procedures. It must be borne in mind that specific process conditions or key properties required may force modification of such general recommendations to suit these requirements in the service environment expected. This means that insulation systems must be selected for specific conditions on a custom basis.

It is becoming increasingly necessary for material suppliers to know how their materials behave in insulation systems designed for the broad types of electrical equipment such as random wound stators, armatures, low voltage form wound coils, specialty transformers, etc. This makes it necessary for these suppliers to do more systems testing by these new functional tests and, of course, to correlate these results with known service experience. This is the incentive back of the organization of a laboratory such as the Insulating Materials Application Center.

It is no longer sufficient to list the drying time, the dielectric strength, and a few chemical and physical properties of a varnish based on film tests over copper, a metal over which they are rarely used in small and medium equipment and which has a marked catalytic effect on many synthetic resins.

Compatibility Factors

Choice of compatible systems may be made by a study of the following factors:

1. Experience in service.
2. Familiarity with known chemistry of materials.
3. The properties of materials.
4. Test data on models using simulated systems.
5. Tests on completed apparatus.
6. Process studies—treating, baking, winding, encapsulation.

Much work has yet to be done to completely spell out significance of data, true end point determination, the problem of extrapolation, etc.

The ability of a motor or transformer to carry loads is limited by mechanical and thermal considerations. The useful life of a motor is determined largely by its insulation and temperature is the number one deteriorating factor. Equipment must be designed with an allowable temperature rise to cover its most severe duty cycle expressed as horsepower, torque, watts loss, etc. This allowance has been expressed as the service factor and has been taken full advantage of by the user in many cases, thanks to superior insulation systems for each particular class. With greater knowledge of systems performance comes a more realistic determination of a more efficient factor of safety as regards dielectric strength, continuous dielectric stress, and the factors influencing ultimate electrical breakdown.

In considering the choice of a compatible insulation system, the user-insulation engineer and the insulation materials supplier must know both assembly and service requirements of the equipment or design. From this the key properties can be chosen and proper evaluation tests to measure them can be undertaken. As regards the behavior of the system, functiona test procedures must be adopted and an evaluation program undertaken. Simulated models must be chosen which are best suited to the application under consideration. More tests must be made at temperatures of operation.

As a corollary, the degree of precision and the time and temperature scale of expected life must be considered in outlining a test procedure. Materials must be analyzed as to chemical compatibility as a functioning of their composition and chemical behavior with a view to giving not only an estimate of potential compatibility but also curing conditions to give optimum properties. It may be that test procedures can be modified and improved or even new test methods developed. The deterrent to the latter is the time necessary to prove the reliability of the test and even more important its significance as a time measure of performance of an insulation system.

It should be pointed out that a critical analysis of all new test programs and new procedures should be made in order to avoid unrealistic tests and improper or unjustified interpretation of results and their significance.

While there is much yet to be done there is much of value already available to guide the designer and the material engineer to better systems There will be incomplete and unexplained discrepancies no doubt, but the whole problem of choice of insulation systems is on a sounder basis than ever before in the history of electrical insulation.

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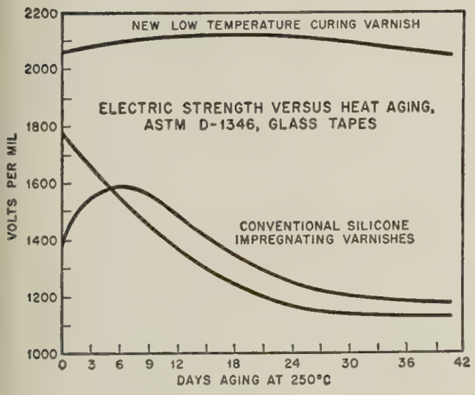

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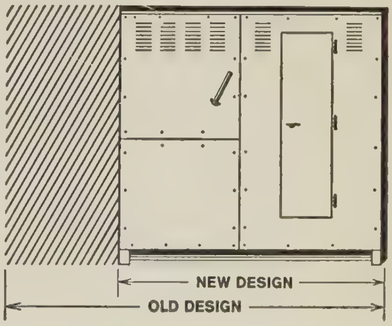

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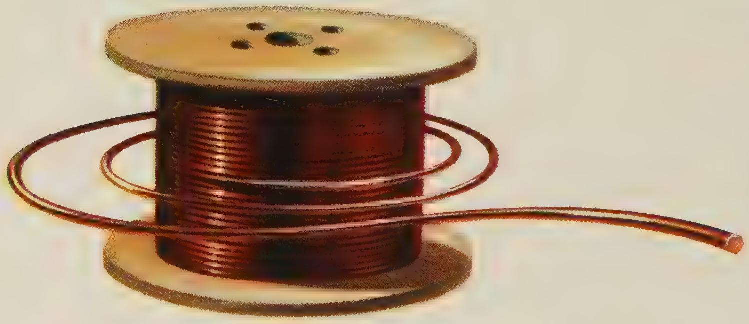

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POLY-HERMALEZE	**155°C**	**60+**	**1400**	**20%-1X**	**20%-3X OK**	**Excellent**	**Good**	**30 lbs.**	**305°C**	**20%-3X OK**	**4000**	**500,000**
EPOXY	120°C	20+	1400	20%-1X	20%-3X OK	Fair	Fair	4 lbs.	200°C	20%-3X OK	3000	200,000
NYLEZE®	130°C	30+	1700	20%-1X	20%-3X OK	Good	—	16 lbs.	250°C	20%-3X OK	2500	200,000
ERMALEZE B®	130°C	20+	1500	10%-1X	10%-3X OK	Good	—	16 lbs.	325°C	10%-3X OK 20%-3X Fails	3000	500,000
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Track-Resistant Coatings

By J. Chottiner and B. V. McBride, Materials Engineering Departments, Westinghouse Electric Corp., East Pittsburgh, Pa

Introduction

Surface carbon tracking of insulating members in electrical equipment is a problem receiving increased attention from both suppliers and consumers of electrical components. Failures of electrical insulation due to surface carbon tracking have been responsible for some damage to electrical equipment. These tracking failures are usually associated with improper maintenance of equipment which permits the build-up of contaminates on the surface of the insulation.

The principal emphasis toward finding a solution to this problem has been placed on the development of track-resistant insulating materials capable of being formed by various techniques into solid track-resistant insulating members. Considerable progress has been made along these lines, particularly in the field of glass-polyester laminates which have dust and fog[1] track resistance values in excess of 300 hours. Progress in the development of track-resistant electrical insulation has also been made in the field of glass-polyester premix materials and to some extent in compositions based on other resin binders.

There is, however, another facet to the problem of developing a track-resistant insulating member which has received relatively little attention to date. This approach involves the development of a track-resistant coating material which can be applied to the surface of inherently poor track-resistant insulators to protect test parts from carbon tracking. Track-resistant coatings have some advantages from both economic and utility standpoints.

Cost savings can be realized over the use of track-resistant solid insulation components by employing a less expensive substrate material with a track-resistant coating. In other applications, such as wrapped resin impregnated paper condenser bushings, design requirements exclude the use of present formable track-resistant compositions. Until such time that changes in design or the development of track-resistant resin impregnated materials permit, the use of a track-resistant coating is the only answer to the problem of producing a track-resistant condenser bushing.

A major application for track-resistant coatings can be found in the rehabilitation of old insulation in service. It would be more desirable to revarnish or refinish old insulating members with a suitable track-resistant coating rather than using the original phenolic base coatings which do not provide a high degree of track resistance protection.

A track-resistant coating, in addition to having high resistance to carbon tracking, must have those other desirable properties normally associated with any good coating. The coating should have good adhesion and resistance to indentation, cracking, peeling, chipping, chemical attack, and impact. Because a track-resistant coating is applied over an electrical insulator, it should possess the required electrical properties of the insulator itself. These properties would include high dielectric strength, high volume and surface resistivities, and low power factors. It is also important that the coating retain these properties over the temperature and the humidity range encountered in operation.

Arc and Track Resistance Test Methods

Before approaching the problem of developing a track-resistant coating, it was first necessary to select a test or tests to be used as criteria for evaluating the track resistance of experimental coatings. At Westinghouse we have expended considerable time and effort in the development and evaluation of arc and track resistance tests. Studies have been mad to determine the degree of correlation between various test methods and o test results with field experience. Since is was felt that no single test know to us could be used to completely evaluate the track resistance of experimental coatings, a number o test methods were employed which embodied various conditions and types of apparatus for inducing carbon tracking. Although some of the test methods used in our evaluation of coatings are essentially tests fo arc resistance, there is sufficient correlation between arc and track resistance test results on insulating materials to indicate that arc resistance tests can be used to evaluate material for track resistance.

The tests used in our work included the dust and fog test[1], Alabama power test, linear track resistance test, circular track resistance test, high power arc test[2], and ASTM arc resistance test[3]. Since carbon tracking is most often found on insulation which is contaminated with dust and moisture, the dust and fog tes and the Alabama power test, both o which employ surface contaminated specimens, were felt to give result which could best be related to failures in application. The Alabama power test requires less time to run and was selected for use in screening materials.

Alabama Power Test

The Alabama power test was developed by Royce L. Murray of th

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[1] "Suggested Method of Test for Dust and Fog Tracking Resistance of Electrical Insulating Materials," Report of Committee D-9, ASTM Preprint 39.

[2] "A Test for High-Power D-C Arc Resistance Electrical Insulating Materials," M. M. Fromm ASTM Bulletin 207, pp. 56-59 (1955).

[3] "High-Voltage, Low-Current Arc Resistance of Soli Electrical Insulating Materials," ASTM Method D49 48T.

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Alabama Power Co., Birmingham, Ala. The test equipment including the electrode assembly is shown in figure 1. The electrode assembly (figure 2) consists of two brass electrodes (3″ x 3″ x ⅛″) with one edge bent at a right angle to the flat face. The bent edge is beveled to a knife edge. The electrodes are spaced 3″ apart and are held in place by an insulator spacer bar. Leads from a 100 kv d-c test set are attached to each electrode at the set screw used to hold the spacer bar.

The test apparatus should include a 20 megohm 100 watt resistor in series with the hot negative polarity lead to the test electrode. This resistor provides ballast so that a uniform current flow can be maintained during testing. It also minimizes capacitive discharges so that current through the electrical discharges is very soft and stable.

The electrode assembly is placed on the surface of the test specimen. A continuous bead of tap water is placed on the surface of the specimen between the electrodes using a medicine dropper. Power is applied to the electrodes. The leakage current through the water path is maintained at a fixed value by adjusting the potential across the electrode gap. In our work with this test, the leakage current was maintained at 2.5 milliamperes. Mr. Murray has worked with the lower leakage currents (½ to ¾ milliamperes) to minimize the thermal burning of the surface of the specimen. The flow of current through the water path causes the water to boil and evaporate. As the evaporation progresses, air gaps develop in the water path. The high resistance air gaps are bridged by electrical discharges in the form of small arcs or scintillations which tend to carbonize the surface of the specimen. The original carbon path is lengthened by continued arcing as the water continues to evaporate until a complete carbon track is formed traversing the gap between the electrodes. Materials with high resistance to carbon tracking will withstand repeated applications of the water path and testing without tracking.

Recent improvements in this test method by Mr. Murray include the use of small absorbent pads as rests for the electrodes. The absorbent pads are moistened with water. The water is drawn from the moistened pads with power to the electrodes and eliminates the procedure of reapplying the water path.

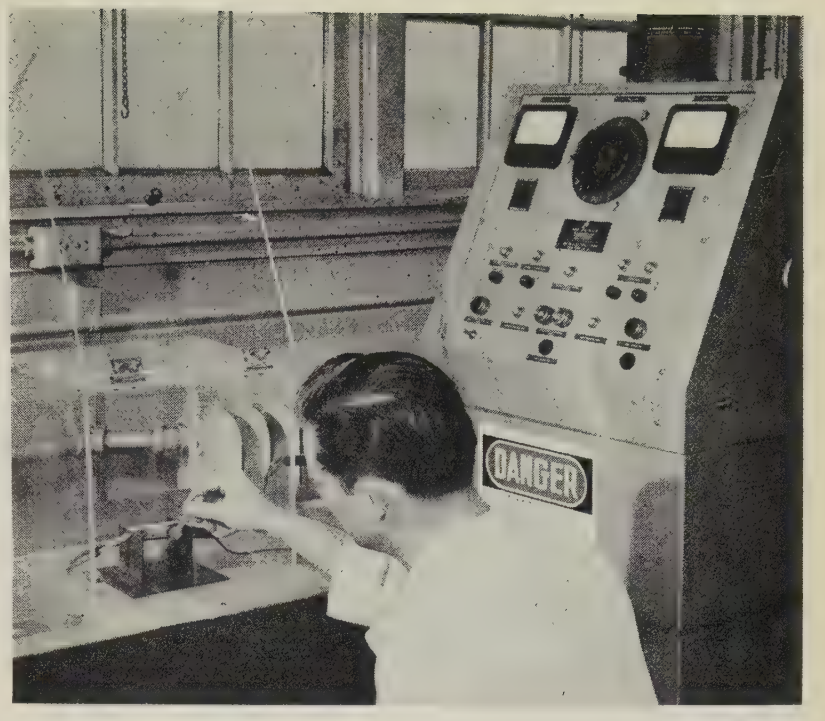
Figure 1, Alabama Power test equipment showing operator applying water path.

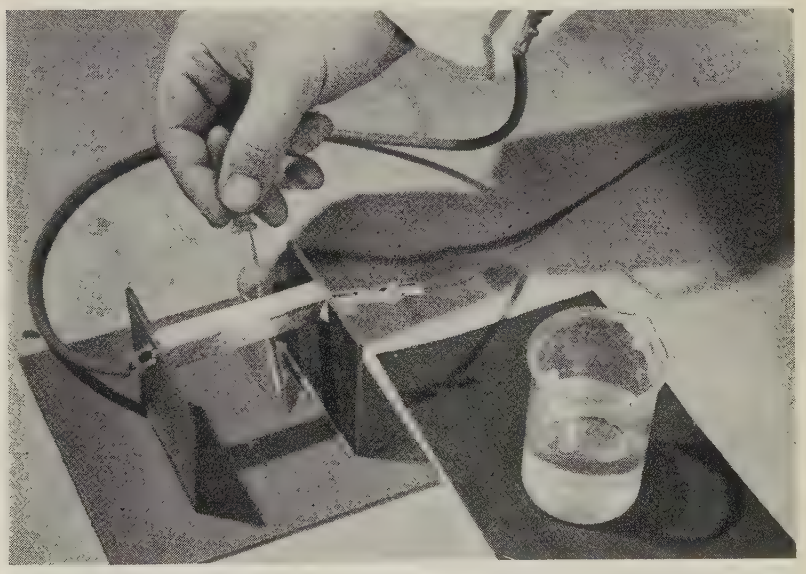
Figure 2, Alabama Power test electrode assembly.

Linear Tracking Test

The linear tracking test used to evaluate experimental coatings is a modification of a test used by Duncan Electric Co. and Rostone Corp. The test apparatus (figures 3 and 4) consists of two tungsten electrodes mounted in laminated plastic insulators so that the electrodes are at an angle of 60 degrees from each other. One electrode is stationary. The second electrode is attached to a screw mechanism which is powered to permit the electrode to be separated at a fixed rate of speed from the stationary electrode. A ½″ x ½″ x 5″ test bar specimen is placed in the specimen holder with the electrodes on the surface of the specimen and separated by an air gap of approximately two mils. Power is applied to the electrodes from a 600-volt a-c transformer to produce a continuous electrical discharge across the electrode gap. The electrical discharge carbonizes the surface of the specimen. After the surface of the specimen has been carbonized, power is applied to the screw drive causing the moving electrode to move in a linear path away from the stationary electrode. The moving electrode is spring loaded to ensure continuous contact with the surface of the specimen. The track resistance of the specimen is determined by the length to which the original carbon path can be drawn before the resistance built up in the carbon track breaks the circuit. Short tracks of less than one inch are an indication of good track resistance. Superior materials resist the lengthening of the original carbonized area.

Circular Tracking Test

The circular tracking test (figure 5) is a modification of the linear tracking test and a test used by American Cyanamid Co.[4] Two tungsten electrodes are mounted in laminated plastic at an angle of 90 degrees from each other with an air gap of $1/4''$ between electrode tips. A 4" disc specimen is mounted on a turntable which is powered by a 1 rpm synchronous timing motor. The electrodes are positioned on the surface of the specimen and a continuous arc is drawn between the electrodes using a 9-kv potential across the electrodes. The electrical arc carbonizes the surface of the specimen between the electrodes. Power is then applied to the turntable and the original carbon path between the electrodes is lengthened into two concentric arcs on the surface of the specimen until the resistance in the carbon path is higher than that of the air gap separating the electrodes at which time the electrical discharge between the electrodes will reappear. The track resistance of a material is a function of the length to which the original track can be drawn. Short tracks (1" or less) indicate good track resistance.

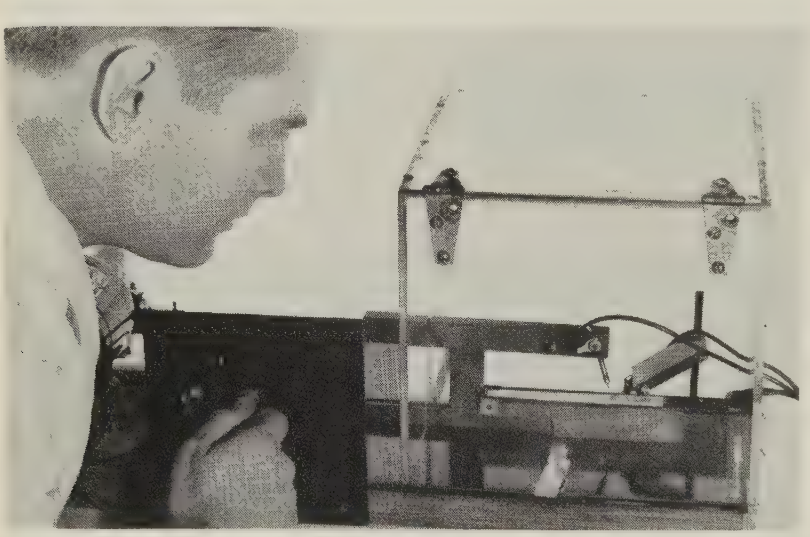

Figure 3, linear tracking tester showing position of electrodes while initiating track.

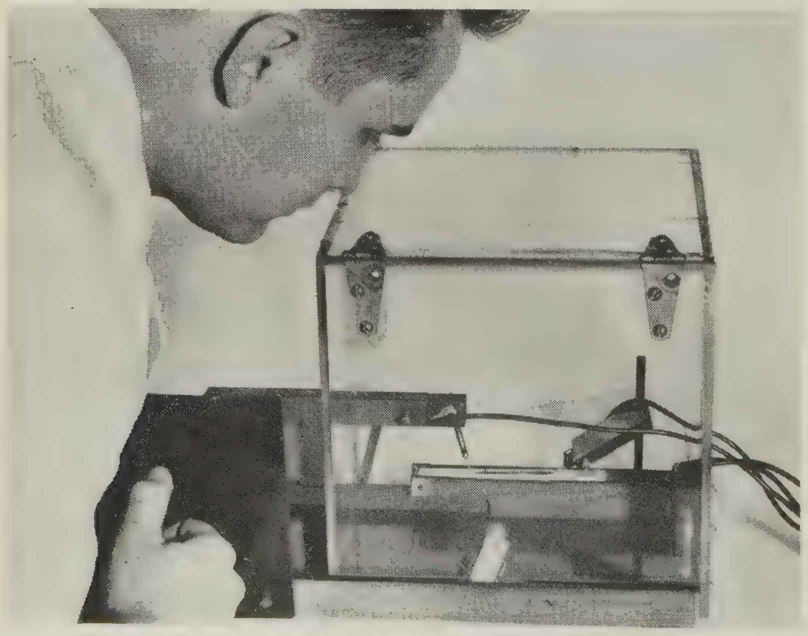

Figure 4, linear tracking tester showing tracked specimen and position of electrodes at termination of test.

Other Test Methods

The three other test methods used in our work to evaluate the track resistance of coatings have been described in published literature. These include the dust and fog test, high power arc resistance test, and the ASTM arc resistance test (method 495D). We feel that only brief descriptions of these tests are necessary and that the reader can make use of the references for more detailed descriptions of the test methods.

The dust and fog test (figures 6 and 7) utilizes a 1500-volt potential and a fine spray of water onto a standard dust contaminated surface to induce small electrical discharges which tend to carbonize the specimen to produce carbon tracks between electrodes on the face of the specimen or which cause erosion through the specimen. The time to erode or track the specimen is a measure of the track resistance of the specimen.

The high power arc resistance test uses two graphite electrodes, a 500-volt, 500-ampere power source, and a thin copper wire to initiate a power arc on the surface of the specimen (figure 8). After each arc, the surface of the specimen is tested for conductivity by reapplying power without the copper wire. The arc resistance of a specimen is a function of the number of arcs that the material can withstand before a restrike occurs.

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[4] "Arc Resistance of Plastics," C. F. Spiers and W. C. Wikstrand. Product Engineering, May, 1955.

The ASTM arc resistance test (method 495D) is widely used in the electrical field (figure 9). This test method uses a 12.5-kv power source and a timing sequence of milliampere current to determine the time to break down a specimen by arcing.

Development of a Track-Resistant Coating

Our investigation to develop a track-resistant coating encompassed a variety of resin, filler, and solvent systems. Some of the resins used were polyester, urea, epoxy, silicone, and melamine. Some of the fillers used included the metallic oxides and silicates. Solvents were selected on the basis of compatibility with the resin component.

Experimental coating mixtures were prepared to yield products of good brushing and spraying consistency. Paper-phenolic laminate and metal specimens were coated to ascertain the coating characteristics of the experimental batches. Those compositions which were difficult to apply were discarded.

Typical problems which were encountered with many of our experimental coatings were short pot life, slow cure rates, poor adhesion, crazing and cracking during cure, brittleness, sagging, excessive air inclusions, and stringing. Some of these problems were solved through modifications in composition. Others appeared to be inherent to the basic composition.

The compositions which exhibited good coating characteristics were next evaluated for track resistance properties using the Alabama power test. Based upon experience gained in our initial tests with this test method, we concluded that an approximate 20-mil coating was required to minimize blistering of the coating due to gassing of the laminate substrate. We found that coatings 20 mils or greater provided sufficient thermal insulation to minimize gassing of the substrate and the resulting blistering of the coating during test.

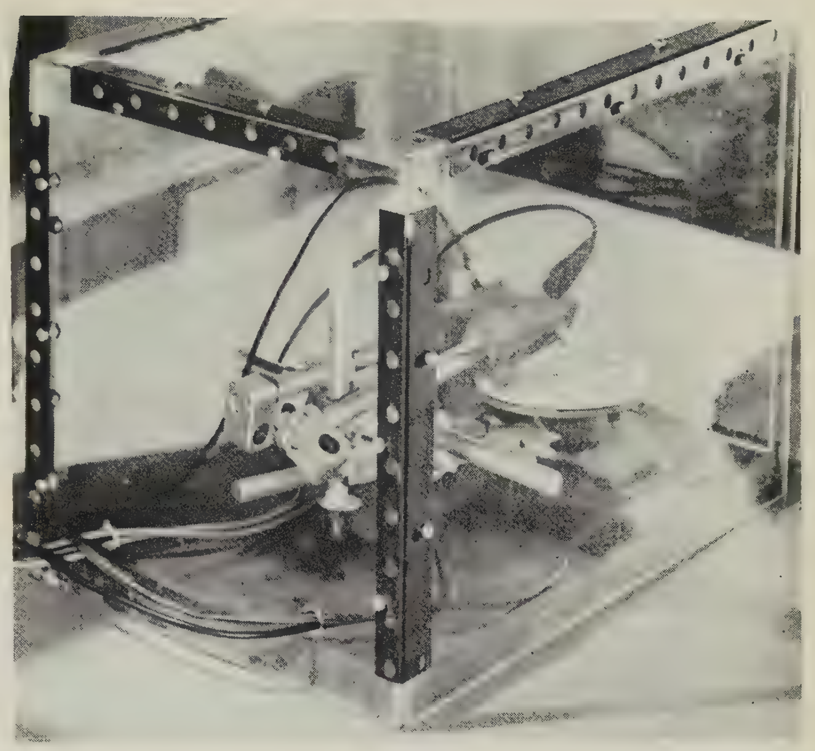

Figure 5, circular track resistance tester.

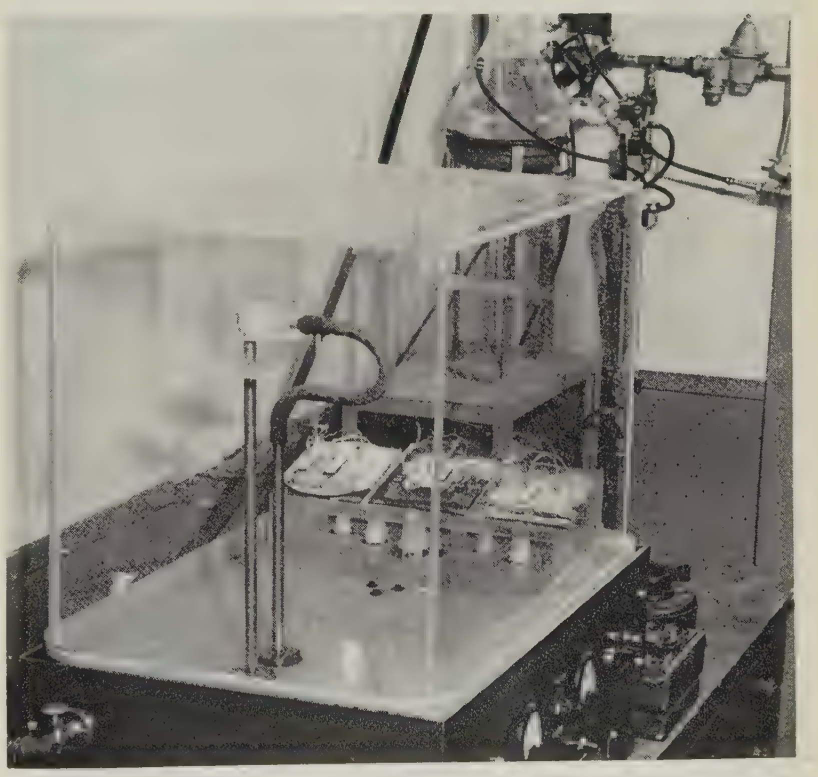

Figure 6, dust and fog apparatus with enclosure in place.

Those compositions which showed good track resistance as determined by the Alabama power test were further evaluated for such properties as adhesion, impact strength, resistance to abrasion, dielectric strength, and surface resistivity.

One insulating coating composition showed a marked superiority over the others under evaluation in having the best combination of track resistance, physical and electrical properties, and ease of application. This material is now being produced and marketed by Westinghouse under the trademark "Limitrak."

Properties of Track-Resistant Coating

This coating has been thoroughly evaluated to obtain complete data on physical and electrical properties. The physical properties are shown in table 1. The coating is highly flexible and does not crack when bent around a ⅛″ mandrel. The coating has high resistance to impact at room temperature (25° C) and at temperatures to 150° C. The coating also has high resistance to abrasion and indentation.

The electrical properties of the coating are good. The coating also has good retention of electrical properties at elevated temperatures, high humidities, and after immersion in water for 24 hours at 25° C (table 2). The coating has a relatively high power factor which is adversely affected with increased temperatures and humidities.

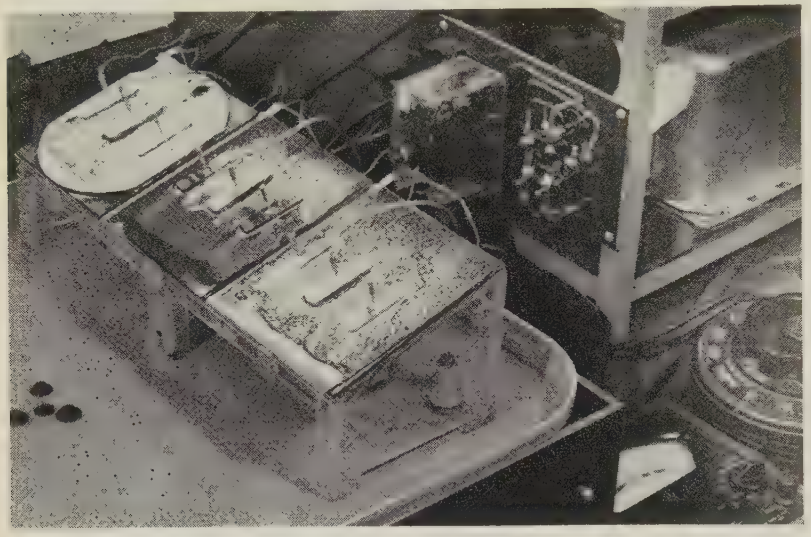

Figure 7, dust and fog test showing close-up of specimens and electrode assembly.

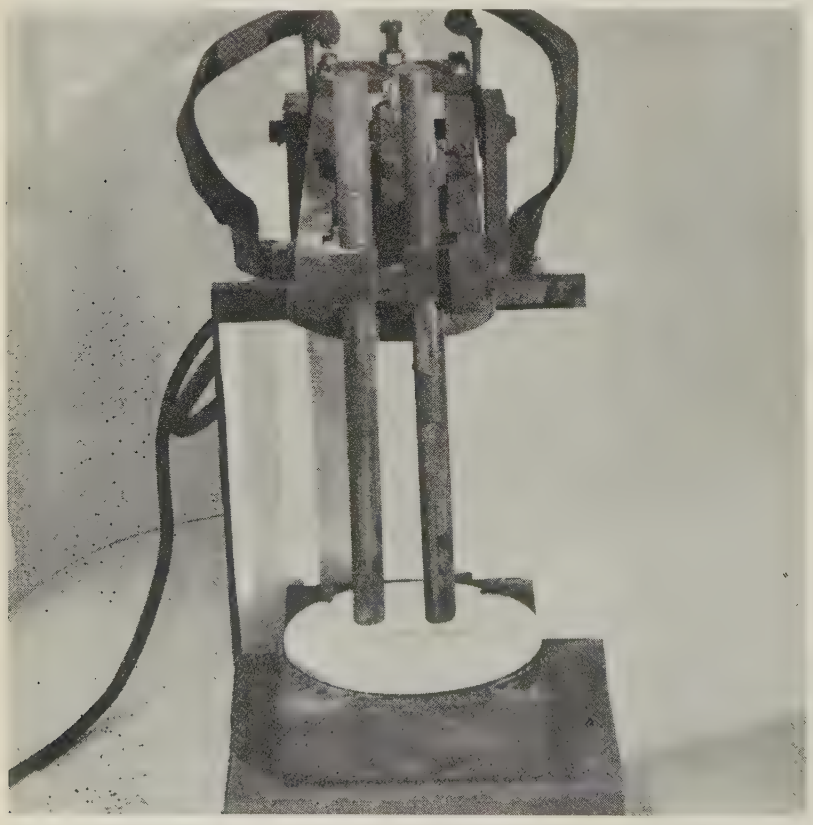

Figure 8, high power arc tester with copper arc-initiating wire on specimen.

Because a track-resistant coating may be used in applications where it may be subjected to various chemical atmospheres and to cleansing with different solvent cleansing agents, it is important to know the effect of these materials on the coating. Table 3 shows the effect of a selected group of chemicals and solvents on the new insulating coating. The specimens tested showed high resistance to attack. The stripping of coatings from the substrate were attributed to the use of cut specimens which permitted penetration along the interface. In general, the coating shows high resistance to chemical attack.

Table 4 shows the results of tests on the six arc and track resistance methods previously described. The new coating shows a marked superiority to a paper-phenolic laminate material on all six tests. The selection of a paper-phenolic type material for comparison purposes was based on the general use of this type of insulation in switchgear equipment and the use of paper-phenolic materials in wrapped condenser bushings. The new coating specimens tested were coatings applied to a paper-phenolic substrate.

An important property of the coating is illustrated in the results obtained on the dust and fog test and the high power arc resistance test. Specimens of paper-phenolic laminate coated with the coating showed erosion through the coating followed by a continued erosion effect on the substrate materials which uncoated fails by tracking very readily. The results of these tests would indicate that the protective properties of the coating are retained after the coating itself has been punctured. We have attributed this effect to the excellent adhesion of the coating which prevents tracking along the interface with the substrate coupled with the difficulty of inducing internal tracking of any material.

As can be seen in Table 4, the new coating could not be tracked by any of the test methods other than the ASTM method. The usual failure was by erosion. Tests run on the Alabama power test were continued for ten reapplications of the water path and then discontinued if no sign of failure was observed. Our earlier experience with this test had shown that if tracking could not be induced in 10 reapplications of water, it could not be induced in numerous succeeding reapplications of the water path. The results of our thorough evaluation on the arc and track resistance of the new coating illustrate the pronounced superiority of this material with respect to arc and track resistance.

A number of additional properties of the coating have been determined. These are shown in table 5. In general, the coating has only fair resistance to weathering and shows a tendency to fade and chalk. This fading and chalking effect diminishes greatly on continued exposure. The coating does not support combustion and is self-extinguishing. The coating shows less pitting and erosion when exposed to corona than does a paper-phenolic laminate material. The track resistance properties of the coating are retained after exposure to thermal aging at 100° C and after abrasion and exposure to weathering. There were no visible effects on the coating after thermal cycling.

The coating has a combination of desirable properties which makes it suitable for a wide range of applications as a coating for electrical insulation. The potentials of this material are further enhanced by the high retention of properties under adverse environmental, temperature, and humidity conditions.

Procedures for Applying Coatings

The coating is basically similar to conventional paint and enamel compositions and can be applied by any of the conventional methods of application such as brushing, dipping, or spraying. The coating composition can be thinned with a compatible solvent thinner to the usual range of viscosities used for applying conventional paints and will in no way be different from conventional paints in such properties as film buildup, surface flow, and smoothness. Normal film thicknesses of conventional paints thinned to the usual range of viscosities are from 1 to 2 mils per coat. It would therefore be necessary to apply from 10 to 20 coats to obtain the required 20-mil coating for a track-resistant application. Obviously, the deposition of a 20-mil film by conventional methods can be done, but this would be an expensive and lengthy procedure. Economic consideration would require that the number of coats necessary to build up a 20-mil coating be held to four and preferably less.

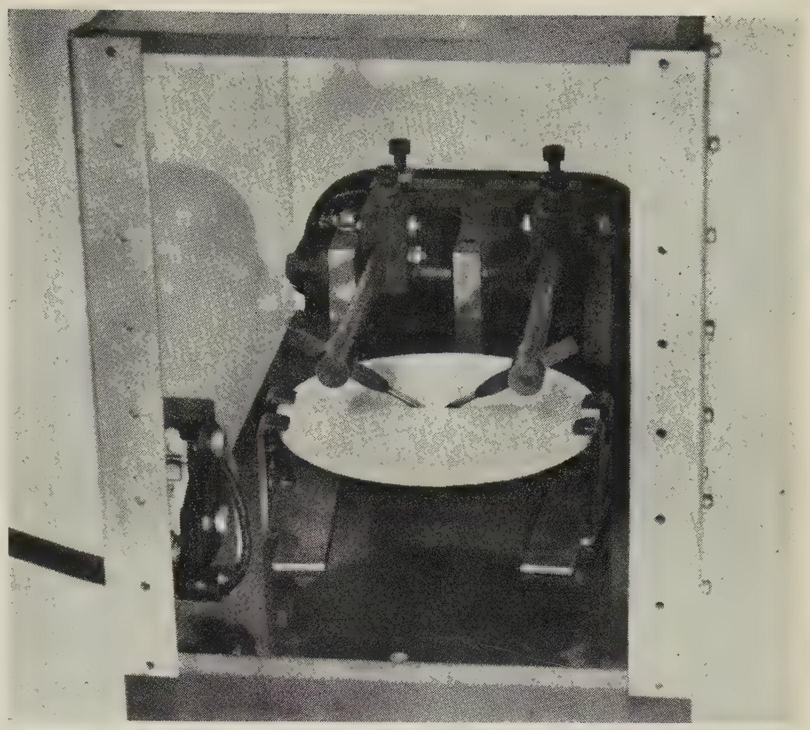
Figure 9, ASTM arc resistance tester showing electrode assembly and specimen in place.

Conventional paints cannot be applied in heavy film thicknesses because of wrinkling and skin-drying problems which are characteristic of the oxidation type curing of these materials. Curing by oxidation begins at the surface of the film and proceeds slowly into the body of the film. The new coating cures through chemical action and the cure proceeds uniformly through the body of the film. This permits the deposition of very thick films without the surface defects of skin-drying and wrinkling. Thick films of the coating can be applied when the viscosity and solids content of the coating are high enough to prevent lowing and sagging of the wet film on vertical surfaces. Low viscosity formulations tend to give coatings that sag and flow in thick coats.

It is possible to apply the new coating by hot spray techniques to obtain relatively thick films. The hot spray method applies high solids, high viscosity material at a temperature below the boiling point of the solvent. Much of the solvent is dissipated in the air when the material is sprayed and the material is deposited on the surface in a highly viscous condition. Thicker films can be applied in this manner before sagging occurs than is possible by cold spraying. With a short drying time to flash off the solvent on each coat to raise the viscosity of the deposited material above the sage point, it is possible to apply additional coats in rapid succession and build up still greater film thicknesses without sagging. Film thicknesses in excess of .020″ per coat can be obtained by this method. Since these operations are done in such close sequence, the entire operation is often termed a one coat application.

There are some problems connected with the hot spraying of the new coating. Air bubbles are deposited in the film during spraying. These air bubbles must be allowed to escape

Table 1—Physical Properties of Track-Resistant Coating (20 Mil Coatings)

Test Method	25°C	90°C	105°C	150°C
Conical Mandrel Bend	No Failure	No Failure	No Failure	No Failure
Falling Ball Impact (Concave Side)	OK 30 In-Lbs.*	OK 30 In-Lbs.*	OK 30 In-Lbs.*	OK 30 In-Lbs.*
Falling Ball Impact (Convex Side)	OK 6 In-Lbs.	OK 30 In-Lbs.*	OK 30 In-Lbs.*	OK 30 In-Lbs.*
Sand Abrasion (Air Blast)				
a) Wt. of sand	78 Kg.	—	—	—
b) Time to erode	3.25 Hrs.	—	—	—
Wire Imbedment (5 Lb. Wt.—2 hrs.) By Electrical Breakdown at 2000 V., 60 Cycles, 1 Min.	None**	None**	None**	None**

**Maximum value on test.*
***Indicates no dielectric breakdown after indentation.*

Table 2—Electrical Properties of Track-Resistant Coating*

Property	25°C	90°C	105°C	150°C
Dielectric Strength (V/Mil)				
(A) 5-mil coating	1200	-	—	—
(B) 10-mil coating	1600	—	—	—
(C) 20-mil coating	650	450	400	200
Surface Resistivity, (Ohm-Cms)	2 x 10^{13}	5 x 10^{12}	2 x 10^{12}	—
Power Factor at 60 Cycles (%)	15.0	33.0	33.0	33.0
Property	**30% R.H.**	**70% R.H.**	**98% R.H.**	**21 Hrs. in H_2O**
Dielectric Strength (V/Mil)				
(A) 5-mil coating	—	—	—	220
(B) 10-mil coating	—	—	—	340
(C) 20-mil coating	>750	>600	>500	450
Surface Resistivity, (Ohm-Cms)	5 x 10^{13}	9 x 10^{13}	3 x 10^{11}	1 x 10^{10}
Power Factor at 60 Cycles (%)	14.6	16.0	23.0	31.8

**20-mil coating unless otherwise specified.*

Table 3—Chemical and Solvent Resistance of Track-Resistant Coating

		Effect	
Material	Exposure (Days)	20 Mil Coating on Aluminum	20 Mil Coating on Paper-Phenolic Laminate
Mineral Spirits	60	None	—
Trichlorethylene	60	Film stripped No attack	—
Ethyl Alcohol	60	Blistered Discolored	—
Xylene	60	Film stripped No attack	—
3% Sulfuric Acid	50	Film stripped No attack	Blistered Cracked
"Inerteen"	50	None	None
Wemco C Oil	50	None	None
1% Sodium Hydroxide	50	Film stripped No attack	None

while the film is still wet and fluid. If surface drying occurs too rapidly, the bubbles are trapped at the surface and adversely affect the properties of the coating. The entrapped air bubbles impart a roughness to the surface which is due to projecting surface bubbles and craters formed by broken bubbles. This effect can be greatly reduced or eliminated by incorporating a slow evaporating solvent into the coating mixture. Such a solvent acts to keep the surface of the applied coating wet and fluid long enough to permit the air bubbles to escape.

Another problem encountered in spray application of relatively viscous materials is a lack of smoothness due to surface rippling. This is caused mainly by the passage of air currents from the spray gun over the freshly deposited wet film. These films do not level out completely while the film is in a wet fluid state. This condition can be corrected by reducing the air pressure to the gun and by holding the spray nozzle further away from the wet surface. Another approach to a solution of this problem is through the use of airless spray methods which eliminate the source of the problem.

The new coating composition is supplied as two separate components which are mixed immediately prior to application. The mixture is usable for a few days after mixing but gradually increases in viscosity which necessitates the periodic addition of thinner to maintain good working consistency. Since each addition of thinner produces a corresponding decrease in solids content which reduces the film build-up per coat, it is highly desirable to complete the application of the coating as soon as possible after mixing the two components.

Thinning is required only to adjust the viscosity of the coating mixture to suit the method of application. For brush application no thinner need be added to the freshly-mixed material, but thinner may be needed later as the viscosity increases due to chemical action and evaporation of solvent. For spray application the viscosity should be lowered by thinning in order to obtain a smooth wet film. The viscosity can also be low-

Table 4—Arc and Track Resistance of Coating (20-Mil Coating)

Test Method	Coating	Paper-Phenolic Laminate
ASTM Arc Resistance (Sec.)	126	72
Alabama Power Track Resistance (Shots)	10+	1
High Power Arc Resistance (Shots)	30-38 (Erodes*)	2
Circular Track Resistance (In.)	No tracks****	11.7+***
Linear Track Resistance (In.)	No tracks****	3.5+***
Dust and Fog Track Resistance (Hrs.)	276 (Erodes)**	1.9 (Tracks)

**Coating eroded in 3-8 shots. Base laminate eroded remainder of shots.*
***Coating eroded in 40-60 hours. Base laminate eroded remainder of time.*
****Track reached limit of specimen.*
*****Original track could not be lengthened.*

Table 5—Other Properties of Coating (20 Mil Coating)

Property	Remarks
Thermal Stability	Good, no change after two weeks at 100°C.
Thermal Shock Resistance	Good, no change after 5-18 hrs. Cycles from −10°C to 80°C.
Flame Resistance	Does not support combustion.
Resistance to Weathering in Atlas Weather-Ometer	Fading after 100 hours. Chalking after 200 hours.
Track Resistance After Weathering 400 Hours	No tendency to fail after 10 shots on Alabama Power Test.
Corona Resistance (Rufolo and Winans, ASTM Publication No. 198)	Powdering but no erosion after 283 hours at 8 KV, 30 mil gap.
Tracking after Thermal Aging at 100°C for 200 Hrs.	No tendency to fail after 10 shots on Alabama Power Test.
Effect of Abrasion on Track Resistance	No tendency to fail after 10 shots on Alabama Power Test.

ered by heating the material in the spray gun as is done when the material is applied by the hot spray method. Since the objective is to deposit a 20-mil film with the minimum number of coats, it is advisable to maintain thinning to a minimum.

The cured coatings are insoluble and care must be exercised to prevent the curing of material in the channels of the spray equipment. Spray guns should be thoroughly cleaned each day by flushing with solvent. Brushes should be washed thoroughly and then kept immersed in solvent.

Summary and Conclusions

There is a distinct need for a track-resistant coating material to protect electrical insulation from carbon tracking in applications to which solid track-resistant materials are not adaptable. There is an additional need for such a material for use in rehabilitating old electrical insulation and insulating components. Track-resistant coatings have some economic advantages over solid track-resistant materials. This is particularly true in the field of rehabilitation of old electrical insulation and insulating components. A track-resistant coating, in addition to having track-resistant properties, must have those other desirable properties usually associated with good coating materials. In addition, these track-resistant coatings should possess electrical properties equal to those of the base insulation to which they are to be applied. The coating should be suitable for application in thick coats so as to require a minimum number of coats to build up a .020-inch coating. It is also desirable that the coating can be air cured for field application where oven facilities are not available. The new coating developed by Westinghouse is a coating material that meets all of these requirements. The need and potential for such materials warrants further development to produce improved materials.

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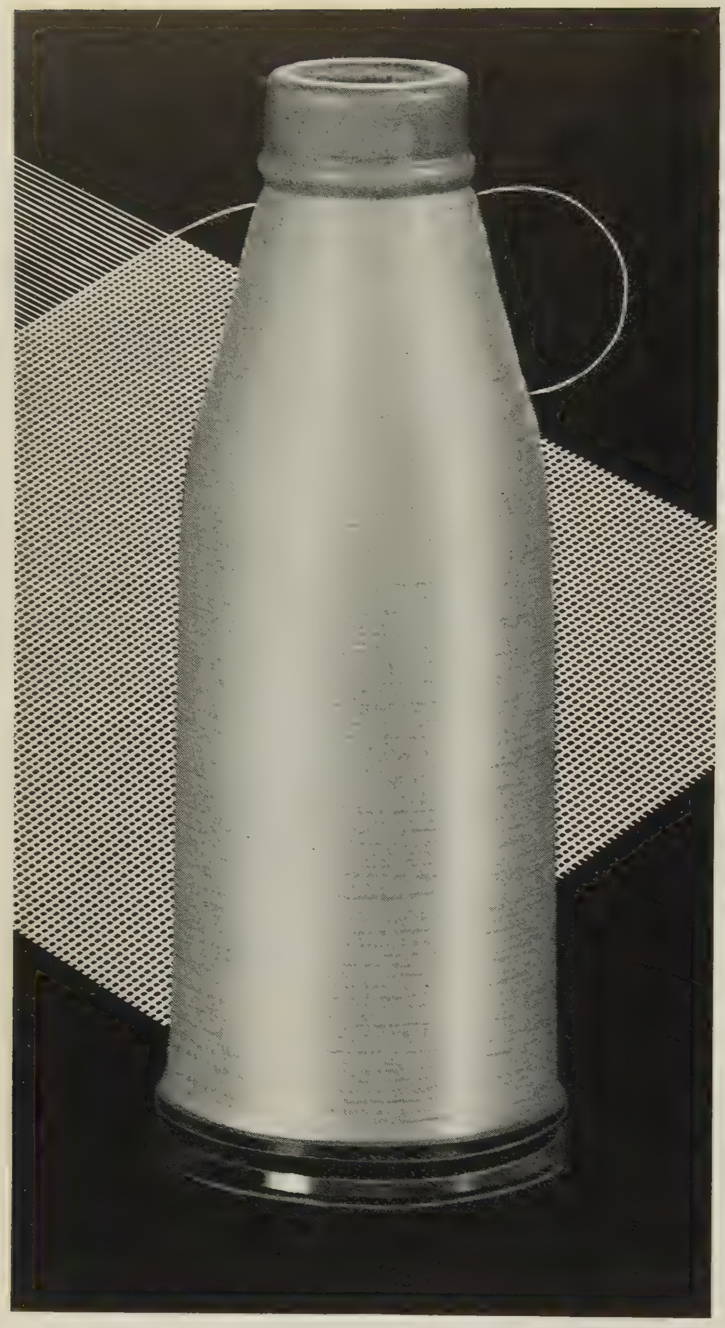

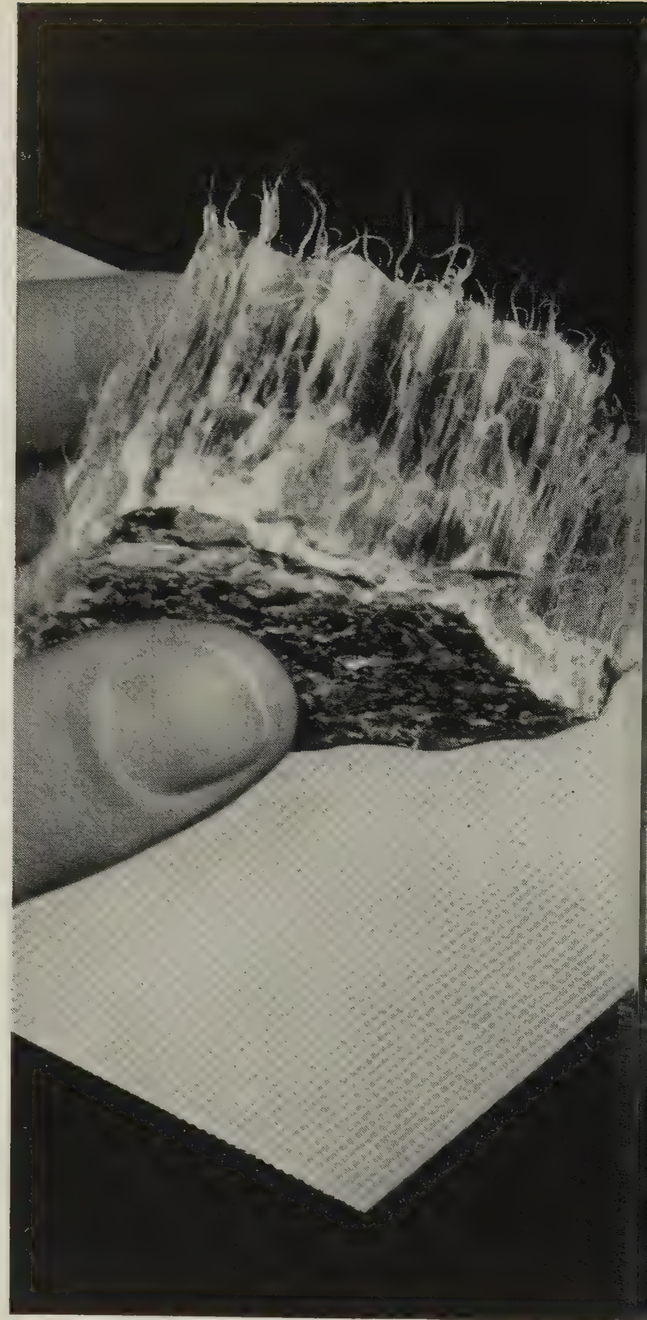

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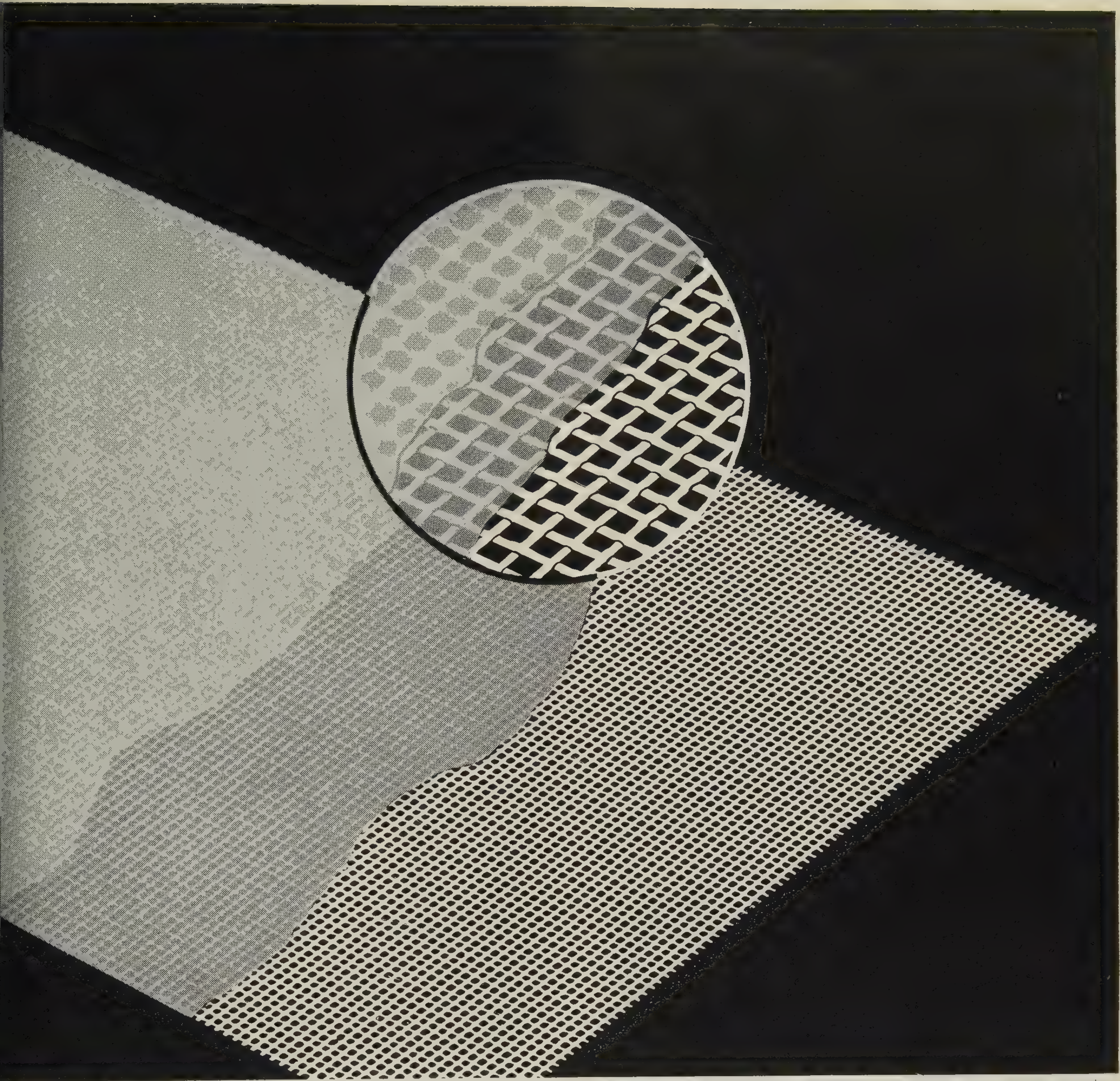

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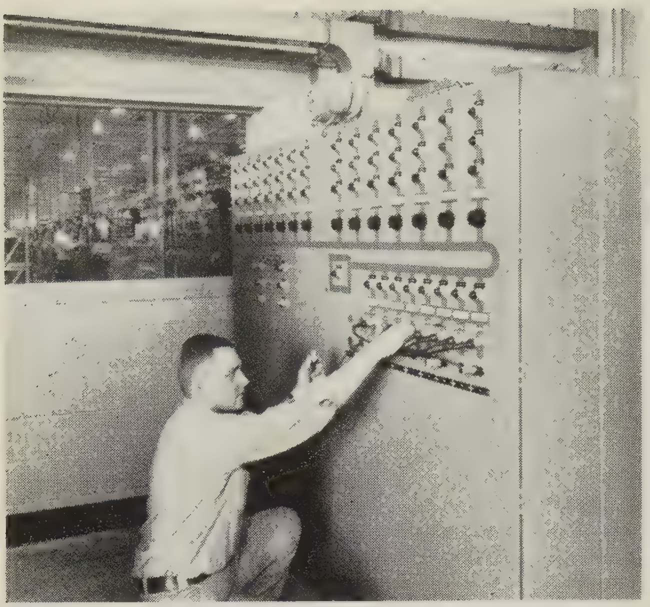


Figure 1, operator at control panel programs pellet flow sequence by manipulating plugs. Board automatically answers extruder request for refill of material. Color to each extruder is controlled by setting of a dial on the panel.

Automatic Handling System For Wire Insulating and Sheathing

An automatic handling system coupled with a tandemized manufacturing process puts color into wire insulating and sheathing operations at Western Electric Company's new Omaha works. The system reportedly permits processing of 2,500 ft. of exchange and switchboard wire per minute, has eliminated the need for permanent storage facilities, and has contributed toward an equipment savings of $600,000.

Directly from shipping containers, the system accurately selects, unloads, and distributes different colored polyethylene and PVC (polyvinyl chloride) pellets to 61 individual coating sites at the rate of 2,225 lbs. per hour. In a week's time, almost 500,000 lbs. of pellets are propelled through the conveyor system at turnpike speeds and at distances of up to 800 ft.

Key components of the system are eleven centrally controlled Dracco Airstream conveyor systems* which serve the bulk handling needs for plastic at Western Electric's 558,000 sq. ft. cable plant. Managed by a single operator monitoring individual static panelboards, the system's high-speed pneumatic action keeps production stations constantly supplied. And it automatically supplies designated process stations with pellets of a specific color at the

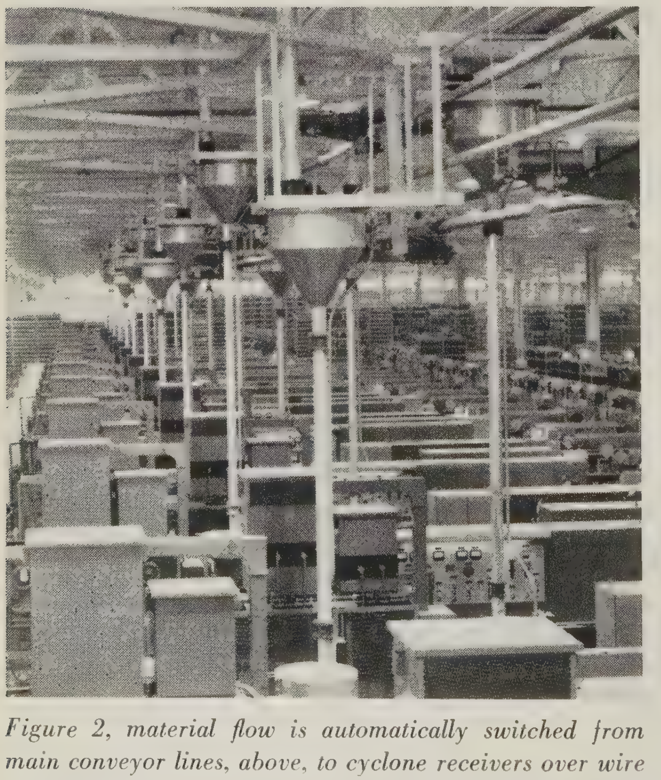


Figure 2, material flow is automatically switched from main conveyor lines, above, to cyclone receivers over wire insulating extruders in processing area. Gravity chute brings pellets into extruder hopper.

**Dracco Airstream conveyors made by Dracco Div. of Fuller Co., Cleveland.*

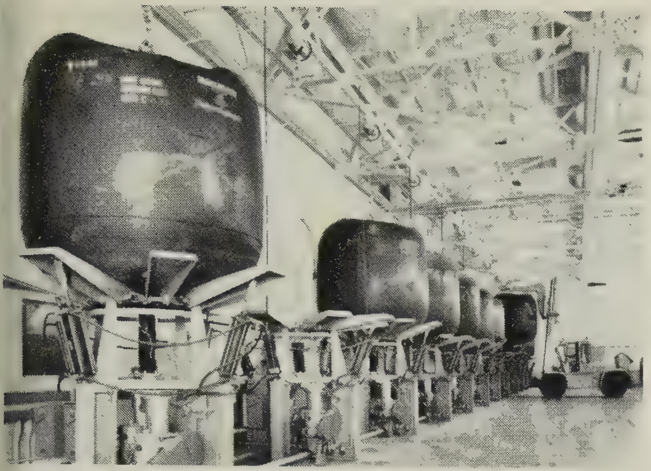


Figure 3, battery of cradles holds polyethylene-filled collapsible rubber containers. Arms adjust pneumatically to bags as they empty. Conveyor lines running under cradles are aluminum with interiors roughened by a patented sand blasting treatment to prevent formation of ribbons and streamers within the system. Rotary feeders under containers are of stainless steel to assure pellet purity and longevity of the units.

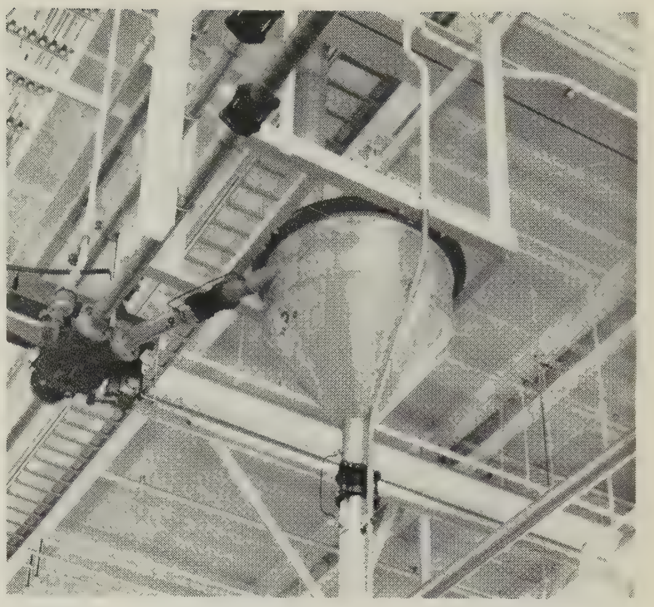


Figure 4, electrically controlled, air-operated diverter valve directs flow to cyclone receiver of designated extruder. Valve is controlled from central panel board in container unloading area.

exact time they are needed.

Integrated with Tandemized Operation

The system is integrated with, and complements "tandemization"—a unique manufacturing innovation at the Omaha plant. Tandemization combines several wire-making processes, formerly done separately, into a single continuous operation. Through conventional machines linked in series, wire is drawn to specified gauges, annealed, insulated, cooled, tested, and reeled. Produced are small gauge wire for switchboard assemblies and larger wire for exchange systems. Exchange wire is grouped into cables and covered in the cable sheathing section, which also is geared to tandemization. This single-line processing gives non-stop manufacturing sequence, better product control, and eliminates the expense of storing and rehandling materials between manufacturing steps.

The conveyor system effectively serves both wire insulating and cable sheathing processes. From 42 extruders in the insulating area, exchange wire is coated with various colors of polyethylene. Different colors provide a code for quick identification of particular strands as they are grouped into cables. The system also moves neutral PVC to machines producing switchboard wire in the same production area, and black polyethylene to six cable sheathing extruders.

Shipping Containers Are Part of System

All 11 conveyors deliver pellets directly from giant, 10,000-pound capacity collapsible rubber containers.* Three conveyors move colored polyethylene to 42 wire extruders. Three conveyors deliver only black polyethyene to 6 sheathing extruders. Three conveyors deliver neutral PVC to 13 extruders producing switchboard wire. And two conveyors deliver grey, ivory, or beige PVC to 2 switchboard jacketing extruders.

The collapsible rubber containers are mounted on large cradles in separate polyethylene and PVC receiving rooms. In the polyethylene receiving area, a battery of 12 cradles accommodates bins containing up to 10 different colors of pellets. Another battery of 4 cradles holds black polyethylene bins. Colored and neutral PVC bins are stored similarly in the other receiving area. Although the system is geared to unload from truck-delivered bins, it readily can be adapted to handle bulk flow from railroad cars if expanded to accommodate this form of transportation.

Multiple conveyor lines running under the cradles receive the bins' contents and pass them on to processing. The use of two or more conveyor lines servicing each container battery permits flexibility in flow sequence. If there is a heavy demand for a specific color, for instance, the demand is answered quickly and efficiently because more than one bin can supply the needed color—or by the same token, one bin can handle simultaneously the color requirements of several processing sites.

Advance Programming Routes Flow

Like the intricate switching operation of a busy railroad marshalling yard, manipulation of a series of plugs on switchboards sets up the flow sequence of tons of a specified type and color of pellet to one or more of the 42 wire extruders—or black to the sheathing extruders. Switch panels located in each receiving room actuate the polyethylene and PVC conveyors. When production requirements are scheduled, data regarding color selection and destination are entered manually on the appropriate switchboards. From that moment, movement is automatic.

**Tradenamed "Sealdbins."*

Until the program is changed, the operator merely monitors the panels' hopper and bin level indicators and makes sure replacement bins are available.

Productivity of a modern handling system such as this one at Western Electric can be enhanced to the point of complete automation. Its design makes it readily adaptable to modern data processing whereby punched cards or by-product punched tape would provide sequence information and at the same time record daily performance for future analysis.

Diverter Valves Direct Flow

As polyethylene and PVC pellets move into the processing area, air-operated diverter valves automatically direct flow from the main conveyor lines to proper extruders. When an extruder is filled, flow passes on to another scheduled for the same color. A flow of a different color may follow shortly but there is no danger it will mix with particles of the previous flow. The system is thoroughly sel cleaning and does not require a purge interval betwee handling of different colors. However, purging was eng neered into the system and is available if required by fu ture expansion or additions to the conveyor network.

Centralized electronic control enables the system t supply itself. When the supply level of an extruder drop below a critical point, the information is relayed aut matically to control, and supply is immediately renewe

Western Electric's installation shows how an ingeniousl designed manufacturing process is enhanced with an eff cient modern handling system. But fast, automatic mate rials movement is just one benefit of the system. Com pletely enclosed, it allows no dust to escape into the plan atmosphere and thus inconvenience personnel and hampe operation of delicate, expensive machinery. Furthermore purity of the contents is assured from the time they leav the manufacturer's warehouse.

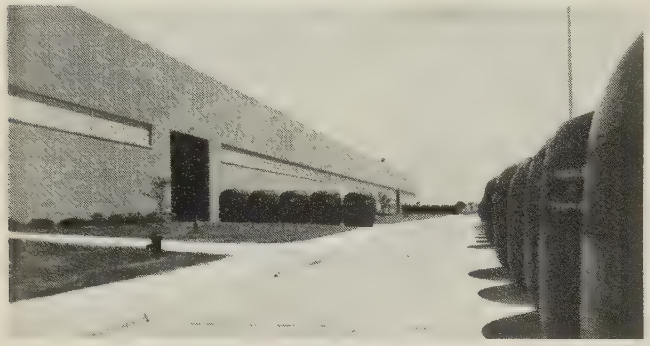


Figure 5, plastic materials used for coating wire and cable at Western Electric Company's Omaha Works remain sealed from outside atmosphere from the time they leave point of manufacture until they are used in process. From these 10,000-pound collapsible containers, polyethylene and PVC pellets are routed to extruders through completely enclosed air conveyor systems.

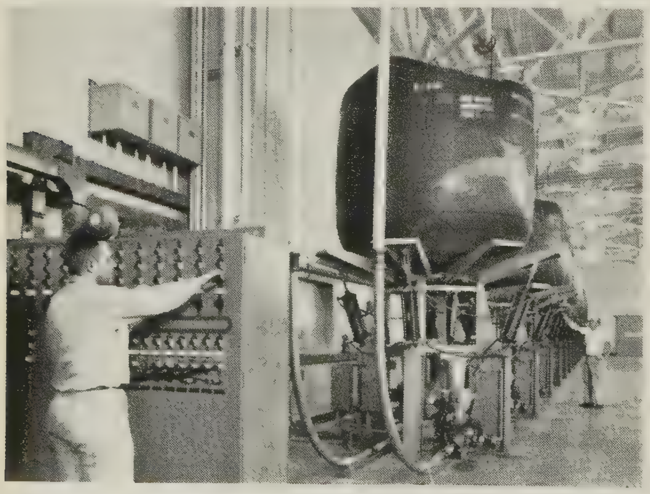


Figure 6, automatic conveyor control takes over the job of moving bulk quantities of varied colored polyethylene and PVC to 61 extruders in the processing area, freeing lone operator to give adequate attention to supply needs at conveyors' points of origin. Ten different colors of polyethylene are fed to the wire coating section from this battery of containers.

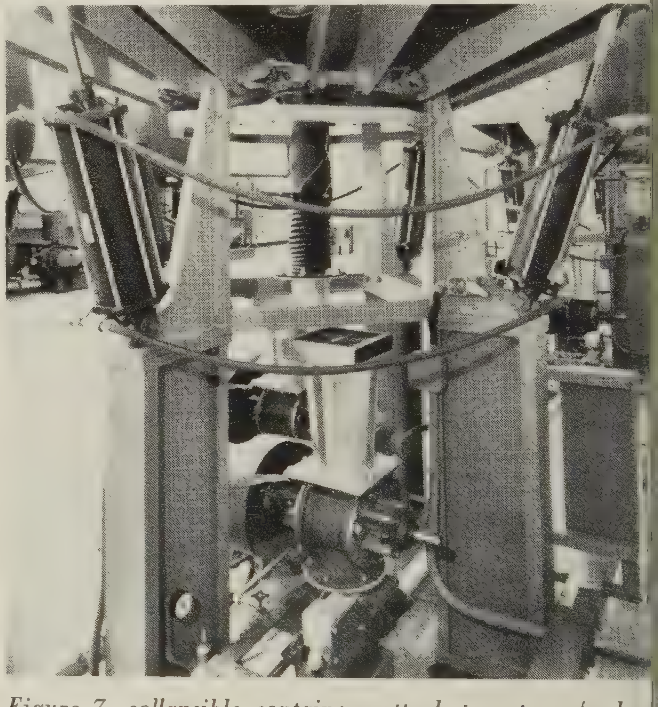
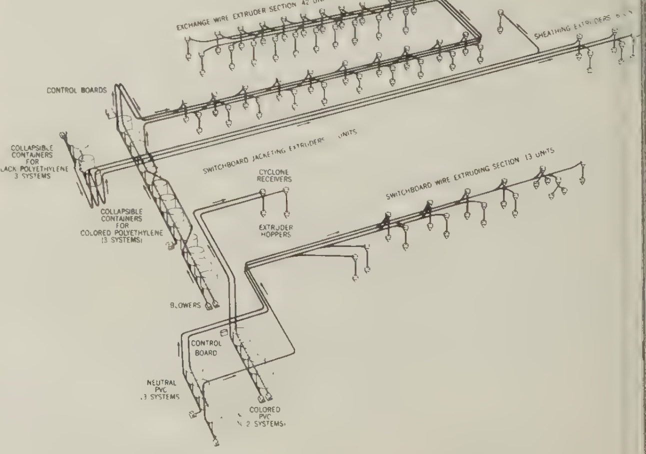
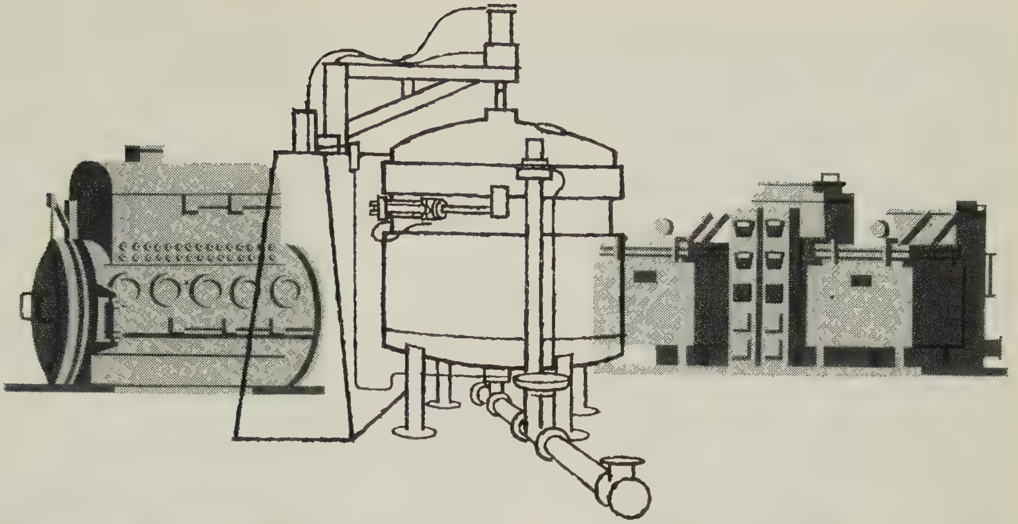


Figure 7, collapsible containers attach to rotary feeder on two conveyor lines. Material flow can be directe through either line, or both when there is heavy deman for a specific color.


EXCHANGE WIRE EXTRUDER SECTION 42 UNITS
SHEATHING EXTRUDERS
CONTROL BOARDS
COLLAPSIBLE CONTAINERS FOR BLACK POLYETHYLENE 3 SYSTEMS
SWITCHBOARD JACKETING EXTRUDERS UNITS
CYCLONE RECEIVERS
SWITCHBOARD WIRE EXTRUDING SECTION 13 UNITS
COLLAPSIBLE CONTAINERS FOR COLORED POLYETHYLENE (3 SYSTEMS)
EXTRUDER HOPPERS
BLOWERS
CONTROL BOARD
NEUTRAL PVC (3 SYSTEMS
COLORED PVC (2 SYSTEMS)



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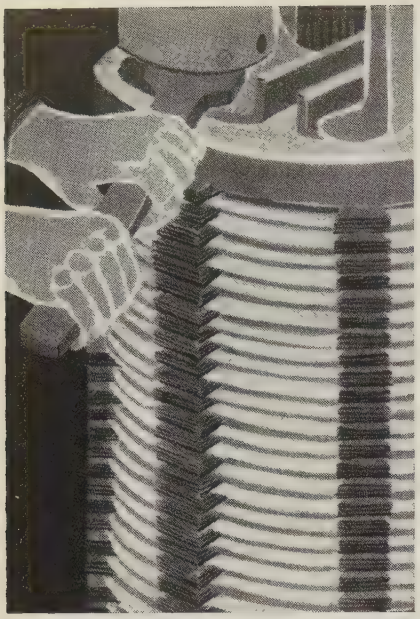

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Industry News

Recent completion of its fifth expansion program since 1945 provides *Lenni Products Inc.*, Lenni Mills, Pa., manufacturer of electrical insulation materials, with 16,500 sq ft of floor space and new equipment in both plant and laboratory.

Fluorocarbon Co., a producer of plastics for the aircraft, electronics, and space-missile industries, recently moved from Santa Ana, Cal., to a new and larger building in Anaheim, Cal.

Applied Plastics Co., El Segundo, Cal., producer of adhesives, coatings, foams, and hardening systems for epoxy resins, has been acquired by *Hexcel Products Inc.*, Berkeley, Cal. It will operate as a division of Hexcel under the direction of F. George Firth, founder of Applied Plastics and now a vice president of Hexcel.

Independent research to determine the reliability of electronic and electromechanical components in commercial and government equipment is offered by a new organization, *Paratron Corp.*, Carle Place, N.Y. Benjamin K. Sachs, formerly with United Aircraft Corp., is president.

Victor Wire & Cable Corp., Los Angeles, has been appointed as a representative for wire and cable manufactured by *Times Wire & Cable Div., The International Silver Co.*, Wallingford, Conn.

Construction has begun on a second irradiation service vault at the Westbury, L. I., N.Y., plant of *Radiation Dynamics Inc.* It will house a 3-million volt electron accelerator with an output of 30 kw of electric beam current.

Service Cable & Wire Inc., Los Angeles, has been appointed to represent *Union Ultra-Sonics Corp.*, Quincy, Mass., manufacturer of ultrasonic cleaners, in California, Utah, Colorado, Nevada, Arizona, and New Mexico.

Modern Plastics, Miami, and *Plastigage Corp.*, Jackson, Mich., have both been equipped to fabricate laminated plastic parts and now stock "Formica" laminated plastics. Both are members of the national "Fabricator of Industrial Formica" organization of *Formica Corp.*, a subsidiary of *American Cyanamid Co.*

The sales and other office departments of the *Electro-Technical Products Div., Sun Chemical Corp.*, have been moved from Nutley to Paterson, N.J.

Plans for the formation of a new company to manufacture amino molding compounds in the Mexico City area are jointly being made by *The Borden Chemical Co.*, a division of *The Borden Co.*, and *British Industrial Plastics Ltd.* BIP, a holding company with factories in England and agents throughout the world, was one of the first companies to manufacture amino molding compounds.

Union Carbide Plastics Co., division of *Union Carbide Corp.*, has established a new sales office in Minneapolis for "Bakelite" plastic molding and extrusion materials. Robert K. Louis, technical sales representative, has been transferred from the Milwaukee sales office to the Minneapolis office.

Anaconda Wire & Cable Co., New York City, has realigned engineering and research activities for communication, electronic and defense products. The newly organized groups are *General Engineering — Communications and Electronics, Hastings Communications Research and Development Center*, and *Missile Cable Engineering and Development.*

General Electric Co., Coshocton, Ohio, has appointed four new authorized distributors for the laminated products department line of industrial plastic laminates. They are *A&A Supply Co.*, Dallas, Texas, *Eiler Equipment Co.*, Minneapolis, *Read Plastics Inc.*, Washington, D. C., and *The Harva Co.*, Scoharie, N. Y.

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Pixilated Patents

By Mike Rivise

(Forty-sixth in a series of odd and interesting inventions in the electronics field from the files of the U. S. Patent Office.)

The year 1859 seems to have been one in which everyone wanted to help those suffering from toothaches endure the agony of extractions or other dental operations by applying electricity to the afflicted areas during the operation. Among the most novel of many patents covering various equipment designed for this purpose was one which proposed that the electricity be applied by means of non-metallic conductors. The inventor, William G. Oliver, apparently saw many advantages in letting moisture do the work, as a moist thread and a wet sponge are designated as the conducting media.

While the invention was designed to produce a local anesthesia for any type of operation, Oliver confined most of the patent description to an explanation of its use in dental operations.

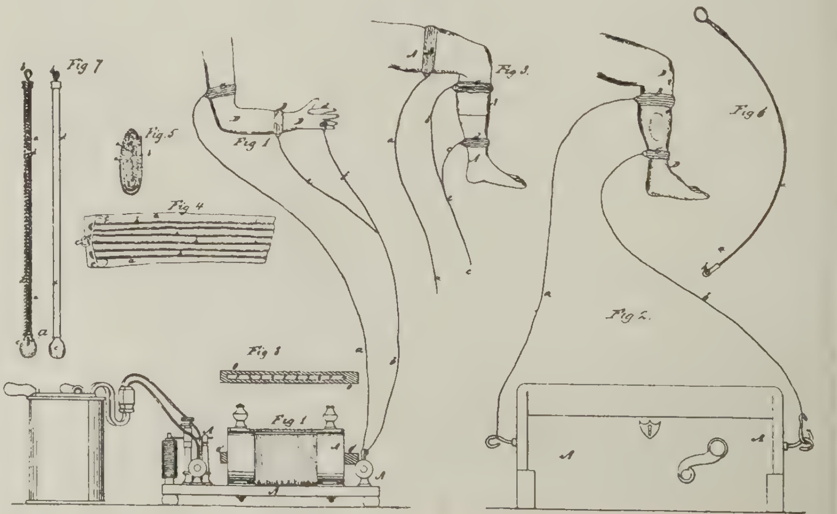
In the accompanying drawings, figure 6 represents an extensor and figure 7 shows a conductor designed to apply the electricity in dental operations. Figure 8 is a view of the regulating-rod of the electrical machine shown in figure 1.

The extensor consists of a small wire wound with thread or silk and connected at one end to a coupling hook and at the other end to another thread. In all dental operations except extractions, the extensor is hooked into one of the wires from a battery or electrical machine, and its loop or thread hooked or wound around the tooth of the patient while he holds in both hands a metallic rod connected to the other wire of the battery. The thread or loop of the extensor is thoroughly wetted before being applied to the tooth.

The conducting wire (figure 7) has an eye at one end which may be connected to one of the wires of the battery and a small piece of sponge at the other end. The whole length of the wire is completely encircled by an india-rubber or insulating tube. In cases of extraction, or where the extensor cannot be put on, this conductor is attached to one of the wires of the battery (the other wire being coupled to the rod in the patient's hand). The sponge is thoroughly wetted, and then held by the operator against the gum of the tooth to be extracted.

As Oliver states in the patent description, "It will be observed that by my method of applying electricity as an anesthetic agent in dental operations no metallic conductors come into contact with the part to be operated upon, which I have found by long practice and series of experiments to be of the greatest importance."

While Oliver does not detail any of the advantages to be derived from the use of the non-metallic conductors, we suppose that perhaps electrocution through non-metallic conductors might be less painful than receiving the deadly shock from metallic conductors.



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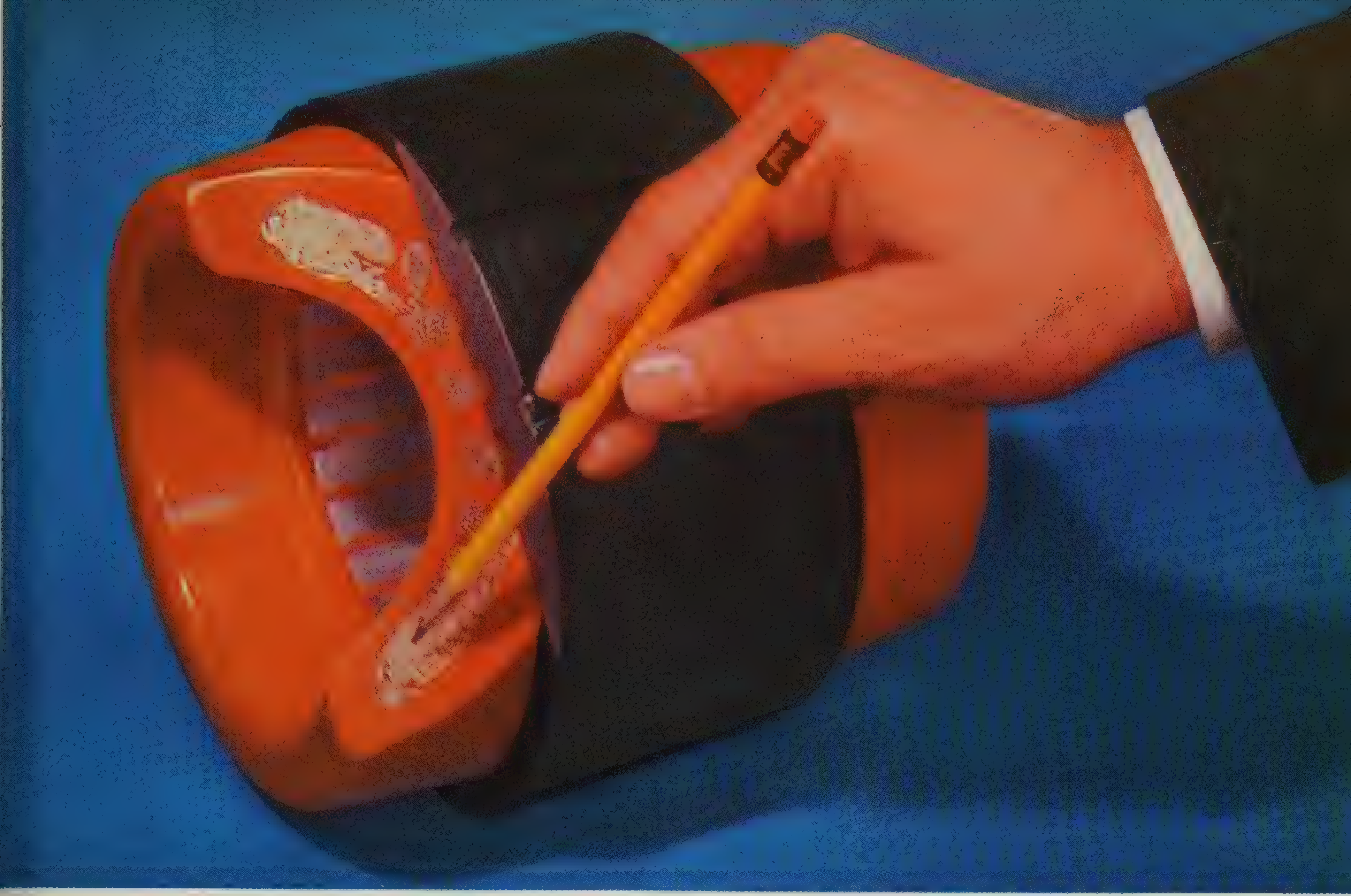

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European Insulation Report

Ed. Note: *The author of this monthly European report is a well-known insulation expert associated with a large European electrical manufacturer. Although it is necessary that his identity not be revealed at this time, correspondence may be exchanged with him by writing* European Editor, Insulation, Box 270, Libertyville, Illinois.

Technology of Water-Powered Generators—The Stator Windings

By K. Abegg, Bulletin des schweizerischen elektrotechnischen Vereins, vol. 51, No. 4, April 23, 1960, pp 428-437. K. Abegg is with "Maschinen Fabrik Oerlikon," Zurich, Switzerland.

This article, among other things, contains a brilliant survey of insulation technology in Europe with respect to stator windings of high voltage generators.

Mica, whether as splittings or as mica-paper, is still today an indispensable component in order to attain the necessary 20-25 kv/mm 1-minute breakdown strength in the slot.

The bonding agents are of critical importance. A distinction must be made between thermoplastics (e.g. asphalt) and thermoelastics (e.g. epoxy, polyester). The author is of the opinion that in spite of creeping with tape insulation and of swelling with folium insulation, asphalt is good enough for machines with small slot lengths and low working temperatures due to its good dielectric properties and cheaper manufacturing costs.

The power companies now demand windings with longer life, i. e. insulation which can be thermally overstressed. This can be attained with thermoelastic synthetic resins. On the manufacturing side, different requirements for the synthetic resin have to be met, according to the manufacturing method adopted.

The manufacturing advantages of pre-impregnated folium or tape stipulate that they fulfill certain requisites such as good storage, freedom from adhesion in the pre-impregnated state, etc. It is difficult to bring such requisites in accord with the dielectric and thermomechanical properties of the insulation.

Corona tests have shown that asphalt is better than the best synthetic resins, and insulations with mica-paper are better than those with mica splittings.

The author then sketches the experiences with folium insulation—which even today is very popular in Europe because of its manufacturing advantages.

Shellac-Mica-Folium: The dielectric properties deteriorate significantly in service. In spite of this they are fit for service for decades. (The European Editor shares this opinion if only the author would add that with over-dimensioning and low thermal stresses as was usual in earlier times, such insulations lasted sometimes over 40 years without giving any trouble).

Asphalt-Mica-Folium is dielectrically better as long as the solvent has been almost completely driven off from the bonding agent during the manufacturing process, but at higher temperatures it is poor mechanically.

Because of this, a folium with synthetic resin was developed about 10 years ago. Thanks to epoxy and mica-paper, this folium has excellent properties. The manufacturing advantages of folium insulation, of course, have to be paid for by a big over-hang (projection) of the windings from the slot end, which is necessary in order to be able to insulate the junction between the slot part folium insulation and the bead part insulation.

In Europe the tendency is more and more toward using a continuous type synthetic resin insulation system of the "Thermalastic" pattern of Westinghouse. Results from tests on different insulation systems are reproduced in this article.

Control of manufacturing as well a of aging of the stator windings i service are also dealt with. The autho comes to the conclusion that th magnitude of the test voltage of finished windings should be as high a possible so that the insulation i tested optimally but not aged. H views ionization measurements (e.g tanδ) for control of manufacturing a indispensable. There are two method which enable one to judge the windings in service without damaging th insulation: a) visual observations, t which the author correctly attribute great importance, and b) electrica tests and temperature measurement which, of course, have not yet bee developed so far that one could draw conclusions about the life of an insulation.

Besides this very brilliant work according to my view, there was the lecture at the Second National Conference on the Application of Electrical Insulation by Mr. Wilhelm Oburger (Engineer for Electrica Technology and Deputy Chief of the Austrian Productivity Centre i Vienna, Austria) which appeared i the Electrotechnische Zeitschrift, Edition A, No. 15 of the 18th July, 1960 pp 517—521, under the heading *Neue Isolierstoffe und Isolierverfahren fur Wicklungen von Grossgeneratoren in Europa und in USA.*

It is not necessary to make any comments on this article which has also appeared in the USA. For the sake of completeness, however, tw other publications about generato windings should be pointed out.

Dielectric Measurements on the Insulation of Stator Windings

By A. Ritter and O. Wohlfahrt, Report No. 122 at the Conférence Internationale des Grands Réseaux Electrique à Haute Tension 1960 (Ritter is with Brown Boveri Austria an Wohlfahrt is with Brown Bover Switzerland).

This work has appeared in Englis

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and therefore is accessible to all. The report concerns itself more with problems of measuring techniques for stator windings of generators in service. When dealing with this subject, it is essential to refer to insulation technique and in particular to experiences with different systems. When trying to judge the serviceability, it is recommended that measurements of insulation current be made as a function of direct voltage, of loss factor (tanδ), and of charging and discharging current with 500 volt d-c. The report concludes with: The results show that the methods in use today do allow certain conclusions to be made regarding the state and serviceability of the winding. However, owing to the wide variety of different insulation systems, it is impossible to lay down any standard values. The readings obtained are characteristic for the particular system and must be interpreted in the light of experience gained with that system.

The importance of such measurements for judgement and as a continuous check on the materials during aging tests are pointed out.

Report on the Work of the Study Committee on Generators No. 17

This report was presented at the same conference meeting by Mr. Leroy from the EdF (State Electricity Commission of France). In this report, he writes about the activities of committee No. 17 and also discusses the very real problem of measuring methods. His conclusions, as well as those of others who took part in the discussion, are identical to the views expressed in report No. 122. Especially, it was again and again shown with the aid of measurement results that the ratios of d-c breakdown values to the a-c breakdown values are not consistent at all. The values vary between ca. 1.4—2.3.

Semi-Conducting Layers for Protection Against Corona Effects In High Voltage Machines

This is an article which to some extent also touches the subject of stator winding insulation. It appeared in "Revue Generale de l′ électricité" Vol. 68, July 1959, No. 7, pp. 465—472. Written by Prof. J. Kucera of Prague, Czechoslovakia, the original title is "Les couches semi-conductrices de protection contre l'effet de couronne dans les machines électriques a haute tension."

In this article the author describes the principles for providing protection against corona by means of semi-conducting paints in the slot part and of increasing resistance of the paint outside the slot. Proceeding from the telegraphic equation he arrives at a formula for the determination of the most suitable resistances for the attainment of a favorable voltage distribution at the slot exit. He explains this by means of an example.

And the Editor's Opinions . . .

The European Editor would now like to express his personal opinions on this "hot" topic regarding the insulation of stator windings of large generators.

Until shortly after the last war, it was usual in the USA to use an insulation consisting of paper (or glass) tape with mica-splittings and impregnated with an asphalt compound in vacuum. In Europe almost every firm had a somewhat different system. There was tape insulation impregnated in vacuum but most manufacturers used mainly a folium insulation. When judging the different systems, one must always bear in mind that what is of decisive influence on their serviceability are not merely the component materials but also the way they are prepared and manufactured, and in particular the way they would be used. There is hardly another branch in insulation technology where the functional tests of the motorette type and the whole theory regarding choice of material and design, corresponding to service experience and not according to material specification, are so true and real as with the insulation of stator windings of high voltage generators. I feel obliged to add "and where the tests necessitated by these theories swallow up so much money."

One has to be extremely careful when rating the results of such tests and evaluating service experiences. Unfortunately, literature is too often used for the purpose of advertising giving too little information on the material concerned, and inadmissable generalizations deduced from individual cases. For example, one speaks of the danger of swelling of the asphalt-mica-folium insulation because the asphalt loses its bonding strength at higher temperatures. The swollen insulation could then remain hanging or tear in the cooling ducts and at the slot exit. But measures are known which, when taken, would to a great extent prevent the swelling and render impossible the hanging of the insulation during heat cycles. The formation of folds with asphalt-mica tapes as a result of creeping is also not a representative property of asphalt. Or sometimes the danger of corona on the conductor bundle is drawn attention to, without differentiating between coils and turns and for example, roebel bars. With the former, a short circuit between turn would lead inevitably to a breakdown; with the last, however, it ha practically no further consequences

Therefore, one has to entertain the criticisms of old or rather traditional systems with great reservations in order not to arrive at wrong conclusions. For without doubt, most of the generator windings insulated in the classical way are serviceable. Bu under no circumstances do I want to give the impression that the "Thermalastic" system of Westinghouse did not signify substantial progress. That it so signifies is proved by the fac that most of the important manufacturers of large rotating machines developed a similar solution and hav this today at their disposal. Som manufacturers commit the error of strongly recommending an insulation developed by them by displaying all possible technical data without worrying as to how far these properties ar indispensable for the length of lif of a winding.

In some cases, a continuous insulation consisting, for example, of glas cloth and mica and impregnated wit a solvent-free polymerizable syntheti resin may be indispensable. In man cases, however, a cheap and teste classical system would suffice ver well. Because of this, in Europe an artly also in the USA, the coninuous synthetic resin insulation will nd use only in extreme cases for a ng time to come. This is because he folium insulation is still the cheapst solution in spite of the difficult peration of wrapping up the slot art with the folium, and continuous sphalt tape insulations have their ig advantages when mounting the vindings. Also, one should not understimate the difficulties associated with he mounting of windings into the slot vhen the insulation is impregnated vith a polymerizable resin. Then too, subsequent dismounting of such vindings from the slots is hardly posible without damage to the insulation.

In many cases, of course, uniform roduction for all windings is desired or manufacturing reasons, so that the nsulating of all windings with a nodern insulation would be a manuacturing and economic (rather than technical) necessity.

A prediction for the future appears ery simple to me. Where there are o manufacturing grounds for standrdization, the classical system will rove for many cases to be sufficiently good and even bring other dvantages.

But if efforts to eliminate mica are uccessful, then it will surely be posible to obtain new and cheaper quipment than is possible today. It s still a long way from the present echnologically possible solutions of nsulating a winding to the ideal ase, where the stator of a large enerator would be wound with a able, similar to a small motor with namelled wire.

The non-destructive measurements n the windings of machines in servce are still in the rudimentary stages ut they already yield results which rovide a lot of information. I do ot believe that a non-destructive neasuring method will be found in he near future which can give clearut information regarding the further ife or even the serviceability of the nsulation of the winding in service.

The European Editor

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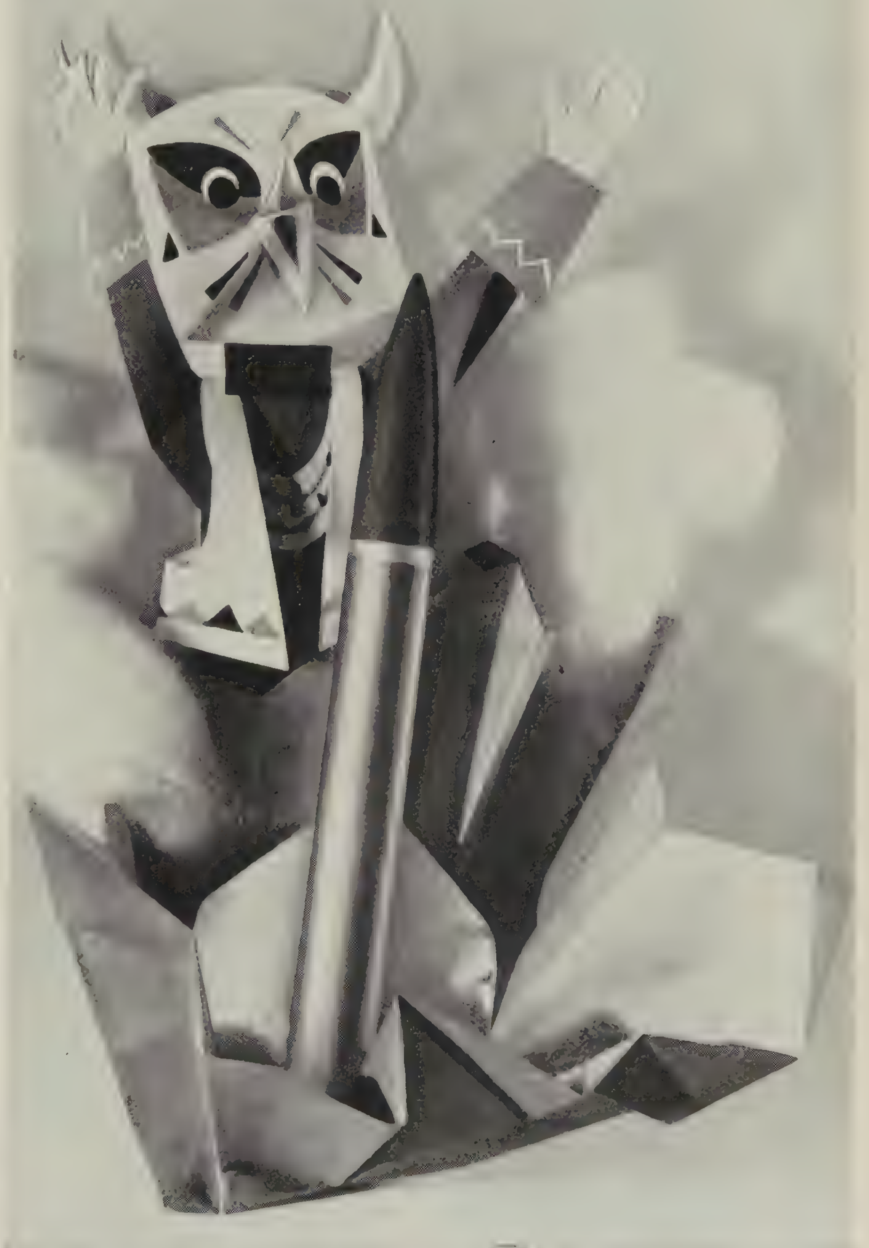
- Meets requirements under Military Specifications MIL-P-17667A.
- Uniform quality—from roll to roll . . . from carload to carload.



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PAPER MILLS COMPANY
MOSINEE, WISCONSIN

FREE—DATA FILE AND PAPER TERMS DICTIONARY
Write Dept. IS-10

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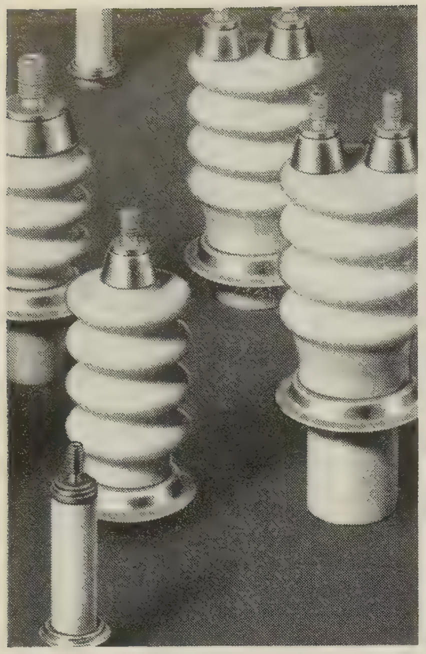

COORS STANDARD TERMINAL INSULATORS

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Coors standard terminal insulators are regular stock items, available for immediate shipping. They are manufactured on a regular production basis, resulting in low manufacturing costs—and low prices.

Coors Terminal Insulators give you these important benefits:

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Coors Offers Complete Ceramic Engineering Service.

Need special terminal insulators or metalized assemblies? A Coors Field Engineer is near you to give you ceramic design help. Call him today—or write for complete Technical Data Sheets on Coors Ceramic and facilities.

REGIONAL SALES MANAGERS

West Coast	William S. Smith, Jr.	EM 6-8129—Redwood City, Calif.
Midwest	John E. Marozeck	FR 2-7100—Chicago, Ill.
Central	Donald Dobbins	GL 4-9638—Canton, Ohio
East Coast	John J. McManus	MA 7-3996—Manhasset, N.Y.
New England	Warren G. McDonald	FR 4-0663—Schenectady, N. Y.
Southwest	Kenneth R. Lundy	DA 7-5716—Dallas, Texas
Southwest	William H. Ramsey	UN 4-6369—Houston, Texas

Coors

COORS PORCELAIN COMPANY

600 Ninth Street, Golden, Colorado

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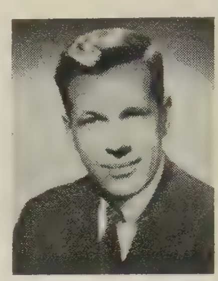
People in the News

Hercules Powder Co., Wilmington, Del., has named *William A. Hoffman Jr.* director of purchases to succeed *Edwin S. Ladley*, who has retired. *Robert Wier III* succeeds Hoffman as assistant director of purchases. *Robert A. Collins*, formerly superintendent at the Hercules Naval Stores Dept. plant at Brunswick, Ga., has been promoted to manager of the Burlington, N.J. plant. *Barron D. Boyd* has been named to succeed Collins.

Irving Cooper, previously with Hermetic Seal Corp., has joined Corning Electronic Components as a sales engineer for resistors, capacitors, printed circuit boards, and metallized glass components in New York City, Long Island, and the New England States. New manager of the electronic components department, Electrical Products Div., is *Malcolm H. Hunt.*

At the Allis-Chalmers Manufacturing Co., Milwaukee, *Edward J. Kleine* has been assigned as an application engineer to the regulator department and *Gerald Lesiecki* has been named as assistant engineer in the compressor department. *Glenn J. Kangas, Thomas J. McDonald, Robert K. Stiles*, and *Lloyd E. Vlies* have been appointed to the nuclear power department.

New general manager of the Johns-Manville Industrial Insulations Div., New York City, is *John Jobe*, former general sales manager for distributor insulation products. He succeeds *Don L. Hinmon*, who has assumed the newly created position of senior operating vice president to administer three J-M industrial products divisions. Jobe has also been elected a vice president of Johns-Manville Products Corp. At Chicago, *E. H. Wells*, vice president of Johns-Manville Dutch Brand Products Corp., has been named general manager of the J-M Dutch Brand Division. *T. H. Eaton*, vice president of Johns-Manville Fiber Glass Inc., has been appointed general manager of the Fiber Glass Division, Toledo, Ohio. *Norman R. Tice* has been appointed a textile glass products sales representative for Sales Corp. in the New York area.



N. R. Tice

R. W. Inm

Richard W. Inman, former ex tive vice president, has been na president of Associated Research Chicago manufacturer of high vol breakdown testing equipment. succeeds the late *James F. Inma*

Norton Co., Worcester, Mass., ufacturer of ceramics and other p ucts, has named *Harold E. Joh* superintendent of the refract plants and appointed *Stephen J. Cabe* superintendent of "Norb and special products.

Sam Cravitt has joined Del tronics Corp., Mount Vernon, high voltage transformer manu turer, as a senior research pr engineer. For the past 14 years has been a research project engi in the infrared field for Farrand tical Co., New York City.

At Union Carbide Corp., New City, *Howard S. Bunn*, former p dent, has been elected to the ne created office of vice chairman of board and *Birny Mason Jr.*, for executive vice president, has elected president. Bunn has been UC since 1922 and Mason since 1 At Cleveland, *Fred B. O'Mara* been named vice president—pro tion, National Carbon Co. Div. He been director of manufacturing.

Henry S. Winnicki, formerly m ager of the Chemicals and Pla Div., Food Machinery and Chem Corp., New York City, has named vice president of the Chem Divisions of FMC. *Dr. Emil Ott* resigned as vice president for rese and development of the Chemical sions but will continue as partnsultant for the company and will so devote himself to academic activi- es. *Sherman K. Reed* has been amed director of research for the hemical Divisions. Formerly re- earch and development director for e Chemicals and Plastics Div., he ill be succeeded in this position by r. *John A. Garman. Leonard G. ussbaum* has been appointed pro- uction manager for the C&P Div., nd will be replaced as resident man- ger of the division's Nitro, W.Va., lant by *A. G. Draeger.* Also, C&P arketing and purchasing director *ert S. Taylor* has been named assist- nt director for mobilization plan- ing, Chemical and Rubber Div., usiness and Defense Services Admin- stration, U.S. Dept. of Commerce.

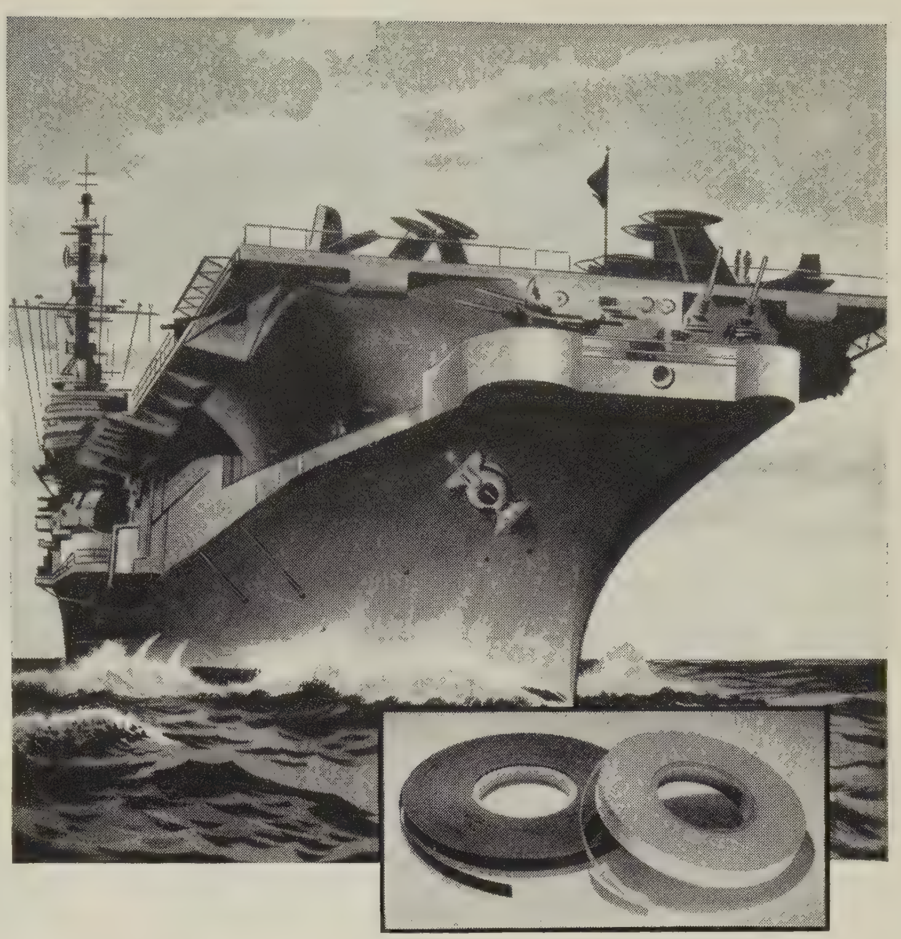
C. Wesley La Blanc, formerly assist- nt to the president of Magnavox Co., s now assistant to the president of nited Industrial Corp., New York ity.

At General Electric Co., Laminated roducts Dept., Coshocton, Ohio, *ichard R. Regen* has been named roduct planner for "Textolite" indus- rial laminated plastics. He has been ith G-E since 1948. At Pittsfield, ass., *Dr. Donald B. G. Jaquiss,* ormerly with Dupont, has been ap- ointed development chemist in the olycarbonate engineering section of he Chemical Materials Dept. The nsulator Dept., Baltimore, has ap- ointed *R. E. Bauer* district sales anager for the Portland, Oregon dis- rict, and *D. P. Lacock* district sales anager for the Pittsburgh area. *. M. Boyd* has been appointed man- ger—engineering of the Insulator Dept. to succeed *Howard A. Frey,* ow general manager.

G. M. Boyd

W. L. Greyson

William L. Greyson has been ap- ointed director of research and de- elopment, Dilectrix Corp., Farming- ale, N.Y., "Teflon" products manu-



R/M NOVABESTOS TAPE

for shipboard cable application

Formulated on a patented asbestos base paper, Novabestos high-temperature tapes are especially suitable for marine cable insulation. Novabestos tapes have superior qualities of heat, water and corrosion resistance, excellent dielectric strength, good handling strength; and cost per unit of area is low.

Novabestos tapes are ideal for Class B or Class H insulation. Available in thicknesses from .0025 to .025 in. in various combinations of asbestos and glass fibers.

Style 7503. Especially suitable for use as impervious sheath in shipboard cables, meeting Military Specification MIL-C-915A. An asbestos sheet reinforced with glass yarns for high tensile strengths and impregnated with PVA. Tape thicknesses of .010 and .015 in.

Style 7504. For primary insulation of cables. PVA-impregnated asbestos with high percentage of glass fiber in base mix. Thicknesses of .008, .010, .015 in.

R/M Novabestos insulating tapes, widths of ½ to 3½ in., are wound on cores of 1½, 3, 4 and 6 in. Write for complete technical data.

R/M

ASBESTOS TEXTILE DIVISION

RAYBESTOS-MANHATTAN, INC.

Manheim, Pa.

SPECIALISTS IN ASBESTOS, RUBBER, ENGINEERED PLASTICS, SINTERED METAL

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facturer. He had been with Hitemp Wires Inc.

Standard Insulation Co. Inc., East Rutherford, N.J., has appointed *Louis Chess* as manager of its Western Div., Los Angeles.

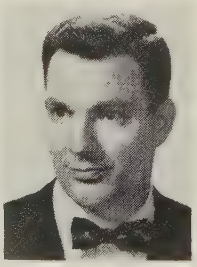
Multi-Amp Electronic Corp., Union, N.J., manufacturer of electrical test instruments and power supplies, has appointed *Ralph J. Dikeman Jr.* marketing manager. He previously was a sales engineer for I-T-E Circuit Breaker Co.

Mobay Chemical Co., Pittsburgh, has appointed *William F. Hering* to the newly-created position of senior estimator and cost control engineer. *William C. Auld*, formerly purchasing agent for Columbia National Corp., a subsidiary of Columbia-Southern, has joined Mobay as manager of engineering purchasing.

Dr. Philip Cooperman has been named to succeed *Dr. Harry J. White* as director of research and development for Research-Cottrell Inc., Bound Brook, N.J., industrial cleaning equipment manufacturer. He previously had served as a consultant to R-C.

Insulating Fabricators Inc., E. Rutherford, N.J., has appointed *Joseph G. Nemeth* vice president and promoted *William G. Ficken* to sales manager. Nemeth has been with the firm since 1947 and Ficken joined it in 1951.

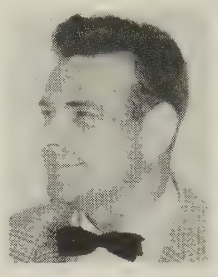
W. Ficken


J. Nemeth

At the McGraw-Edison Company's Toastmaster Div., Elgin, Ill., *Henry Olson* has been named vice president in charge of development and manufacturing. He had been plant manager of the company's Bersted Manufacturing Div., Macon, Mo.

John C. Fedoruk has been appointed technical director of the General Chemical Div., Allied Chemical Corp., New York City, to succeed *Dr. Howard H. Hurmence*, who was recently named assistant director of research and development for the corporation. With the division 19 years, Fedoruk has been assistant technical director for the past 6.

Richard Cook has joined the engineering staff of Technology Instrument Corp. of California as an electronic component engineer. He will direct the company's expansion into lumped constant delay lines.


R. Cook

K. Eklund

Dr. Karl Eklund has been appointed director in charge of research and applied ion physics, Radiation Dynamics Inc., Westbury, L.I., N.Y. Eklund formerly was at the Pegram Nuclear Physics Lab., Columbia University.

Dr. Harry K. Ihrig, vice president in charge of research for Allis-Chalmers Mfg. Co., died recently. He had been with Allis-Chalmers for 10 years and most recently headed a group of scientists responsible for the development of a fuel cell capable of powering an experimental tractor. At the York, Pa. works of Allis-Chalmers, *Dale F. Eyster*, with the firm since 1947 as a sales engineer, has been named project manager, nuclear products, while *Richard K. Gregory*, with the company since 1957 as a staff assistant to the works manager, has been named assistant project manager, nuclear products. The Allis-Chalmers Industries Group has appointed *Marvin A. Bail* assistant engineer, motor and generator department, *Donald Powichroski* application engineer, switchgear department, and *Marquis B. Robinson*, engineering scientist in applied research—all three recently completed a training course for graduate engineers.

Formica Corp., Cincinnati laminated plastics manufacturer, has assigned *H. B. Beswick*, former district sales manager in Seattle, to head its newly established sales office in Honolulu, Hawaii. John C. Van Doren, formerly a sales representative in
Los Angeles district, will succe
Beswick.

Charles A. Wyman, formerly a v
president, has been elected chairm
of the board of The Pantasote C
Passaic, N.J., manufacturer of vi
film and polyvinyl chloride res
Ralph M. Wyman has been elect
a director. Newly elected president
Henry W. Wyman, former vice pre
dent, and *Harry A. Russell* has be
promoted to executive vice presid
from vice president.

New general manager of the M
tary Products Div., Tempo Inst
ment Inc., Hicksville, L.I., N.Y.,
George J. Sbordone, who join
Tempo in 1958.

G. Sbordone

D. Reynold

Donald P. Reynolds recently join
Technology Instrument Corp. of Ca
fornia, as a physicist.

Appointments at Allis-Chalme
Industrial Equipment Div., inclu
that of *G. A. Saar* as general manag
mechanical departments, and of *W.*
Terry Jr. as general manager, el
trical departments. Saar is now
sponsible for operations of the pr
essing machinery, compressor, a
West Allis pump departments. Ter
will direct operations of the Norwo
(Ohio) Works and the rectifier s
tion at the West Allis Works. T
control department has appoint
Donald E. King supervisory engine
special control, engineering grou
William L. Ringland (left in phot
chief engineer of the motor and ge

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Come to the 1960 nsulation Conference on New Methods, Materials for Equipment Design

Once a year the National Conference on the Application of Electrical Insulation tells you, and shows you, what is going on in the whole field of electrical insulation. It brings you up to the minute on current and advanced phases of the art . . . spreads out for you a dynamic display not only of products but of techniques, technology and trends which it would be difficult to get in any other way—even if you had the time.

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erator department, recently was presented the company's first Scientific and Engineering Award and $5,000 by president *Robert S. Stevenson* (center) for his invention of a new way of transposing conductors in large generators. Other person in photo is *Dr. Harry K. Ihrig*, vice president, Research Div., and chairman, Senior Engineering Committee.

Curtiss S. McCune has been named division purchasing agent for Hercules Powder Company's Purchasing Dept., with responsibility for purchase of essential materials.

Sylvania Electric Products Inc., a subsidiary of General Telephone & Electronics Corp., New York City, has elected *Arthur L. B. Richardson* a senior vice president. At Seneca Falls, N.Y., *Henry K. Kindig* has been appointed general manufacturing manager for the picture tube operations of Sylvania Electronic Tubes Div. He has been replaced as manager of the television picture tube plant at Ottawa, Ohio, by *Charles H. Miller*. At Needham, Mass., *Hunter C. Harris* has been named technical manager of the Systems Engineering and Management Operation of Sylvania Electronic Systems Div. And *Joseph D. Schantz* has been appointed director of engineering at the Waltham (Mass.) Laboratories.

Now filling newly created positions at Consolidated Systems Corp., Monrovia, Cal., an associate company of Allis-Chalmers Mfg. Co., Bell & Howell, and Consolidated Electrodynamics, are *Bliss M. Bushman* (director of systems engineering) and *John D. Gum* and *James T. Sharpsteen* (assistant directors of systems engineering).

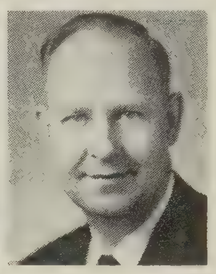
Irvin P. Seegman has been elected vice president of Products Research Co., Burbank, Cal., manufacturer of coating and potting compounds. Seegman, who joined the firm in 1950, will continue as technical director.

Herbert Weil has been named general manager of the sales office and warehouse recently opened in New Haven, Conn., by Commercial Plastics & Supply Corp., New York City.

The Dayco Corp., formerly The Dayton Rubber Co., has named *Carl A. Fuller* assistant director of purchases to succeed *C. A. Griep* who retired after more than 28 years with the company.

John R. Wheeler has retired as active manager of Standard Machinery Co., plastics and rubber processing equipment manufacturing division of Franklin Research and Development Corp. *Philip C. Greene* has assumed his duties as manager of the Grand Rapids, Mich., division.

P. Greene


L. Lindstrom

Leonard J. Lindstrom, with the company since 1940, has been appointed manager of engineering and research, Despatch Oven Co., Minneapolis, Minn.

The Sun Chemical Corp., New York City, has appointed *T. A. Langstroth* technical director of the Chemicals Group, including Facile and Electro-Technical Products.

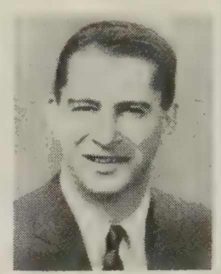
A new project engineer at CRS Industries Inc., Philadelphia, is *George Maleno Jr.*, formerly chief of the engineering department, Bryant Air Conditioning Corp.

D. W. Frasier Jr., formerly with Standard Asbestos Mfg. & Insulating Co., has been appointed merchandising manager of electrical insulating products, asbestos paper, and millboard, at Keasbey & Mattison Co., Ambler, Pa. *John R. Wilson* has been named plant engineer there, and *Emil F. Krynick* has been picked to fill the newly created position of operations research analyst.

Gorham Manufacturing Co., Providence, R.I., has appointed *Kenneth Duncan*, previously with Raytheon Manufacturing Co., staff scientist of its electronics laboratory.

Professor *Robert L. Sproull*, solid state physicist at Cornell University, has been appointed director of a Government-sponsored program for the expansion of basic research in the science of materials which provides a $6,100,000 grant during the next four years.

Tom L. Mohr, formerly a materials buyer for Western Electric Co., has joined Taylor Fibre Co., Norristown, Pa., producer of laminated plastics and vulcanized fibre, as a sales engineer in New York.

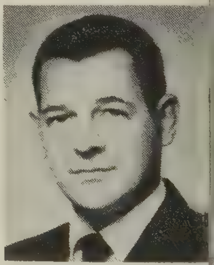

T. Mohr

R. Weesner

Robert J. Weesner, who has 25 years of rotating machinery sales and engineering experience, has been named vice president, sales and engineering, The Imperial Electric Co., Akron, Ohio. *H. T. Bewlay*, who has been with Imperial since 1923 and who has been in charge of engineering, will continue as a vice president and engineering consultant.

The Narda Microwave Corp., Mineola, N.Y., has appointed *Leonard I. Kent* director of engineering and promoted *Donald R. Robertson* to works manager.

L. Kent


R. Russi

Ralph A. Russi Jr. has been elected vice president in charge of research and engineering and will also serve as a director, Tang Industries Inc., Waltham, Mass., manufacturer of semiconductor materials.

New chief engineers at the Electrical Products Div., The Electric Autolite Co., Toledo, Ohio, are *Robert W. MacKay* (generators) and *Roger DeYoung* (alternators).

Dr. K. E. Shuler, an authority in the fields of chemical kinetics, statistical mechanics, energy transfer, and molecular spectroscopy, has been appointed consultant to the director of the National Bureau of Standards.

Higher cut-through temperatures with new Formvar/based enamel

A new FORMVAR based magnet wire enamel has been developed specifically for hermetic as well as general purpose service. The new insulation offers excellent cut-thru resistance . . . up to 300°C . . . your assurance of faultless performance during periods of high overload. Also, it offers outstanding resistance to Refrigerant-22. Plus the same service-proven balance of properties of standard FORMVAR-with-phenolic enamels.

Consider this unequalled combination of key properties:

- Refrigerant-22 extractible content below ½%; excellent blister resistance before and after prebake.
- Excellent moisture resistance as determined by the boiling water test.
- Wet dielectric strength greater than 2000 volts per mil after 24 hour submersion in distilled water.
- Electrical resistance retained at elevated temperatures.
- Thermal life of 60,000 to 100,000 hours at 130°C when overcoated with suitable varnishes.

This new enamel has been well proved in the field. The enamel or coated wire is available from your regular supplier under the FORMETIC or other trademark. Consult him for more details on how this new insulation will pay you real dividends in trouble-free performance.

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Day and night
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more ampere turns,
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an engineer learns.
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Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What quality control measures, test or performance certifications, etc., if any, do you think should be required of suppliers to make sure insulation materials and insulated components meet customer specifications?

Robert H. Rahiser

Quality Control Specialist, Magnetics Inc., Butler, Pa.

"In looking over the overall problem of how to specify adequate quality control measurements to insure sufficient and acceptable insulation properties, many things must be taken into consideration. Most of the general requirements have been covered by such specifications as MIL T-27A, ASTM D-257-58, and other general specifications. However, these do not cover all applications and environmental conditions.

"In looking at this general problem, there appears to be three categories that must be defined in addition to the insulation requirements. These three categories fall under test conditions, sampling procedures, and assurance.

"An example would be the insulation of a component part such as an encapsulated core used in filter work. These component parts are encapsulated to allow winding to be applied directly to the component without additional insulation such as taping. However, under what conditions must this insulation meet the minimum voltage breakdown specification to fulfill this function? Some of these conditions are relative humidity, ambient temperature, environmental atmosphere, the process used in mounting external spacers and mounting brackets, and after-winding conditions such as potting and coating. At present there are no known general specifications to cover such questions or others that will arise in the futur in this age of space technology.

"Secondly, if these items are specified, how do you control or correlat such results to assure a reliable product? Will sampling by attributes a outlined by MIL 105A be sufficien or should a method of sampling b variables be used? Should correlatio be carried out and if so, how often Should the method of testing be destructive or non-destructive? Shoul it be on a go no-go basis or on minimum value? And last but no least, what guarantee or assuranc can be given to assure that the specifications have been met and that th product is reliable?

"In looking at these three genera categories, it appears that the following must be specified, either as general specification or by specifi instruction.

1. Test conditions—The test conditions, including method of testing must be defined so that the purchase and vendor are testing under simila conditions.
2. Sampling—The method of test a to whether destructive or non-destructive must be defined. Based on th method, sampling plans can be determined and acceptance levels established so that an acceptable product is manufactured by the vendo and received by the purchaser.
3. Assurance—Material certificatio may be required, but many are meaningless unless the methods are simila and correlations have been made between purchaser and vendor. Therefore, to assure that the insulation requirements are met, correlations mus be made and checked periodically.

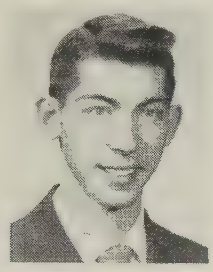
"The three categories are ver broad, but if well defined can assur an acceptable and reliable product.

Pryor McGinnis, Jr.

Standards Engineer, Melpar Inc Falls Church, Va.

"To make sure insulation material and insulated components meet customer specifications, suppliers shoul include with each order a certificat of compliance to existing military or ASTM specifications where applicable. When no applicable specifications exist, a warranty could be included with each order indicating the characteristics controlled during manufacturing and the quality level maintained.

"Customers that require certain characteristics of materials or components that are not normally controlled during manufacturing should include these characteristics in a specification control drawing. It is the supplier's responsibility to ensure that the materials or components meet the requirements of the drawing."



D. Thompson

Materials Engineer, Lear Inc., Grand Rapids, Mich.

"In this age of high reliability electronic devices a potential customer must be assured that the insulation materials and insulated components he uses will meet his particular specification requirements.

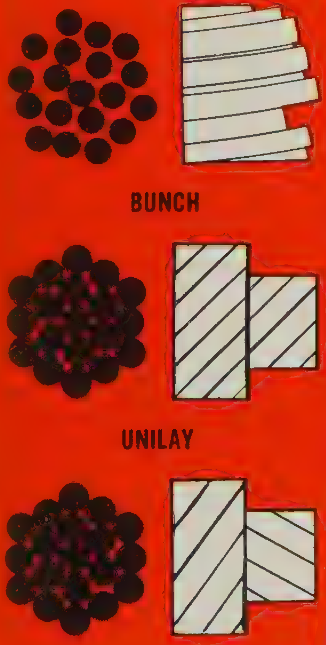
This assurance can only be given if the supplier has established adequate quality control measures during manufacture and followed with a meaningful test program before release of the product. There have been examples of suppliers considering it more economical to ship their product without the expense of testing and then simply replacing the defective material when trouble occurs. This is certainly false economy for both parties involved.

"The supplier should have a complete understanding of the customer's requirements in order that his test program be meaningful. This could be helped greatly if customers would furnish their suppliers with the latest issue of the specifications with each order.

"Customer's specifications must also be realistic, giving consideration when they are written to the manufacturing problems with which the supplier is faced. It is often good policy to consult with the suppliers when a new specification is being written. Specification requirements should be limited to those factors which actually have some bearing on the intended function of the material or component.

"In all cases the supplier should certify that he understands the specification and has met all its requirements."

ISOESTERENE, the new insulating material with unbelievable dielectric properties, is sold by only one salesman, Chester Haskfortheorder. Meet him at the Insulation Conference Marketing meeting in Chicago, Dec. 8.



Which Wire Construction is Best . . .

Hudson makes all three in bare and plated constructions. Each is best suited for particular applications and insulating materials. For many years, the industry "standards" were bunch and concentric strandings. But with Hudson's marketing of unilay, there has been a strong swing to this versatile construction.

. . . for your Application

BUNCH constructions are generally used for flexible cords and fixture wires complying with UL standards, ASTM, and all military specs where permitted.

UNILAY constructions should be utilized where concentricity is a major requirement, or for economic reasons to get more for your insulating dollar. Since unilay constructions are preformed and twisted in the same direction, they are uniform and smaller in O.D. than bunched or concentric constructions. Unilay constructions are suited for all bunched applications, and are being substituted for concentrics in many applications with comparable performance at considerably lower conductor cost.

CONCENTRIC Where concentric strand conductors are required by customer or military spec, Hudson's concentric wires will meet the most exacting requirements.

For additional information on stranded and single-end conductors — bare and plated — write to:

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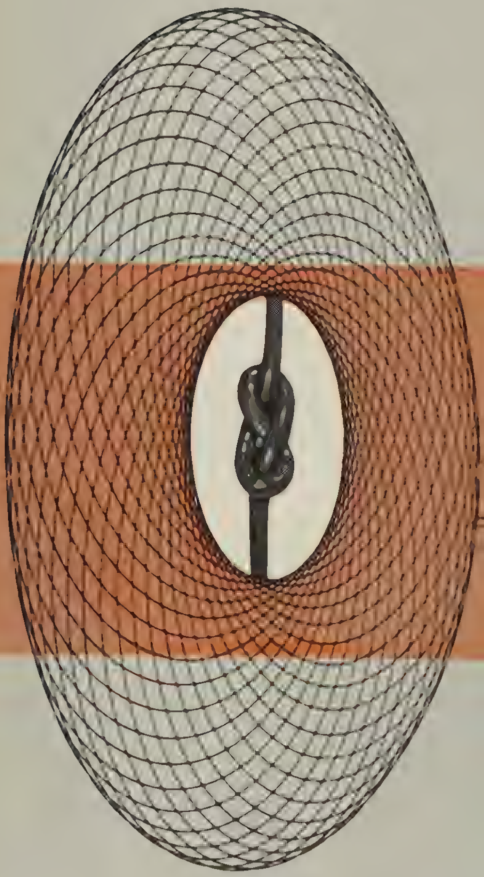
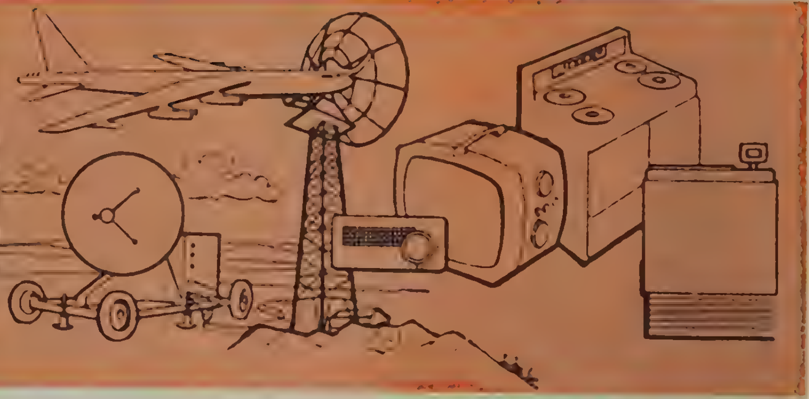
**Circle the entire range of
Tubular Dielectrics**

To solve insulation problems or to spark new ideas . . . Brand-Rex Turbo sleevings run the spectrum of insulating materials . . . from extruded polyvinyl chloride and teflon tubing to a complete line of cotton, rayon, and glass braids coated with vinyl, silicone, silicone rubber or alkyd varnishes. A complete range of sizes in classes A, B, F and H. Both tubing and zipper tubing configurations available.

Important, too, is the reliability built into Turbo products. Reliability based on the experience of 40 years and the capability of a technically-oriented organization with three plants located from coast to coast, all backed by the vast resources of the American Enka Corporation. It makes sense to call Brand-Rex!





This comprehensive brochure and sample board give complete technical information. Write for yours today.

BRAND
REX

WILLIAM BRAND-REX DIVISION

American ENKA Corporation

DEPT. T, 36 SUDBURY ROAD, CONCORD, MASSACHUSETTS
Vinyl, Teflon, Polyethelene, Nylon and Silicone Rubber Wires and Cables
Electrical Tubing and Sleeving — UHF Cast Plastics — Plastic Extrusions

Print Ins. 26 on Reader Service Card

Association News

Webster Elected President of National Electrical Week

Harold A. Webster, president, T. Frederick Jackson Inc., has been elected chairman of the 1961 National Electrical Week Observance. Webster, who is also president of the National Electrical Contractors Assn., has served as treasurer of the National Electrical Week Committee since its formation in 1956. In his new post he succeeds N. J. MacDonald, president of both the Thomas & Betts Co. Inc. and the National Electrical Manufacturers Assn.

Hartig Reecives First IRE Annual Achievement Award

Dr. E. O. Hartig, assistant manager of the aerophysics department at Goodyear Aircraft Corp., Litchfield Park, Ariz., will receive the first annual achievement award of the Phoenix Section of the Institute of Radio Engineers. Dr. Hartig was selected for his "contributions to the development of advanced radar systems and outstanding leadership in research."

Van Alstyne Named Chairman Of 1961 NISA Convention

John S. Van Alstyne, co-owner and manager, Van Alstyne & Sons Electric, has been named general chairman of the 28th annual convention of the Electrical Apparatus Service Association, Inc. (This will be the new name of the National Industrial Service Association after April 1, 1961.) The convention will be held in San Francisco June 11-14, at the Jack Tar Hotel. More than 1,000 are expected to attend.

New Award to Be Presented at Electronics Conference, Oct. 10-12

The National Electronics Conference will present a new $500 award during its 16th Annual Conference and Exhibition at the Hotel Sherman in Chicago on October 10-12.

The new award will be given to the author of the best synoptic or tutorial paper presented during the previous year's conference. The author's selection, organization, and evaluation of material, plus scholastic level and clarity of presentation, are criteria for the new award.

The NEC will also present a $500 award for the best original paper presented during the previous conference, as it has done for many years past. Criteria for this award are originality, importance of contribution, clarity of presentation, and scholastic level.

Hard-bound editions of the 1960 proceedings containing the 100 papers which will be presented during the meeting will be available during registration. Price per copy is $5 at the registration desk, $6 for mail orders. Subjects include all phases of data gathering and transmission, computers, circuit and control theory, parametric devices, microelectronics, plasma physics, and engineering management, plus a special joint NEC-AIEE symposium on logic and switching circuits.

ASTM Committee D-27 Meets Nov. 1-4

The fall meeting of Committee D-27 on electrical insulating liquids and gases of the American Society for Testing Materials will be held November 1-4 at the Williamsburg Motor House, Williamsburg, Va.

Wire Association Meets November 14-17 in Chicago

The annual convention of the Wire Association will be held November 14-17 in the La Salle Hotel, Chicago.

BRAND-REX TURBO® INSULATING SLEEVINGS

Circle the entire range of Tubular Dielectrics

To spot the insulation materials that will solve your problem, just glance through this list of Turbo tubings and sleevings:

Applicable Specifications	Operating Temperature
TURBO† Varnished Cotton and Rayon	
MIL-I-3190A NEMA VS1-1957, Type 1 A.S.T.M. D-372	−10° to +105°C
TURBOGLAS† Varnished Glass	
MIL-I-3190A NEMA VS1-1957, Type 2 A.S.T.M. D-372	−10° to +130°C
TURBOTUF† Vinyl Coated Glass	
MIL-I-21557 MIL-I-3190A NEMA VS1-1957, Type 3	−10° to +130°C
TURBONITE† Isocyanate Coated Glass	
Class F Material	−10° to +155°C
TURBOSIL† Silicone Varnished Glass	
MIL-I-3190A NEMA VS1-1957, Type 4	−10° to +200°C
TURBO 117† Silicone Rubber Coated Glass*	
NEMA VS1-1957 TYPE 5	−73° to +200°C
TURBOTHERM 105† Vinyl	
U/L A.S.T.M. D-922, Grade C	−17° to +105°C
TURBOLEX 105† Vinyl	
MIL-I-631C, Grade c	−20° to +105°C
TURBOLEX 85† Vinyl	
A.S.T.M. D-922, Grade A	−32° to +60°C
TURBOLEX 76† Vinyl	
MIL-I-631C, Grade a	−39° to +80°C
TURBOLEX 40† Vinyl	
MIL-I-22076	−55° to +80°C
TURBOZONE 40† Vinyl	
MIL-I-7444B	−67° to +75°C
TURBOTEMP Teflon	
MIL-I-22129A AMS-3653 B**	−200° to +250°C

**Also meets applicable performance requirements of MIL-I-631C and MIL-I-3190A

*Meets performance requirements of MIL-I-3190A

†Registered trade mark

Turbo Tubings are available in all sizes from #24 to 2½". Write for complete information.

BRAND REX

WILLIAM BRAND-REX DIVISION

American ENKA Corporation
SUDBURY ROAD, CONCORD, MASS.

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NEW DEVELOPMENT IN CLASS B INSULATION

DM-70
DM-100

Dacron Mat
Dacron Mat
Mylar

Dacron* Mat (Epoxy Treated) —
Mylar* Combinations

New Milamat Composites Outperform Other
Class B Materials And Reduce Insulation Costs

TESTED — by U. S. Naval Research and Industry Laboratories
APPROVED — by Bureau of Ships, U. S. Navy
ADOPTED — by leading motor and transformer manufacturers

NEW IMPROVED BONDING QUALITY
NEW INDEFINITE SHELF LIFE
NEW LOWER PRICES

for
Layer insulation
Phase insulation
Slot insulation
Coil spacer insulation
Other applications where varnished glass cloth is normally used.

These new Class B combinations and constructions were developed by Milam to fulfill a functional and economic need long required by the electrical industry. DM—70 and DM—100 have excellent heat aging or thermal stability, good chemical resistance and high physical strength. They are extremely insensitive to moisture, which reduces leakage substantially. Dielectric strength is high, depending upon total thickness of the combination. Thicknesses range from .005″ to .020″.

Write for complete descriptive data.

MILAM ELECTRIC MFG. CO.
1100 ELMWOOD AVENUE • PROVIDENCE 7, R. I.
A SUBSIDIARY OF THOMPSON RAMO WOOLDRIDGE INC.

MEMCO Products For
The Electrical Industry

QUALITY
SERVICE
ECONOMY

Rag Paper — Mylar, 2 and 3 ply • Kraft Paper — Mylar, 2 and 3 ply Rag or Kraft—Acetate combinations • Quinterra—Mylar, 2 and 3 ply Quinterra or Quinorgo — Glass Cloth, 2 and 3 ply • Silicone Quinterra — Glass Cloth, 2 and 3 ply • Friction Coated Mylar, 1 or 2 sides • Rag Paper — Varnished Cambric or Varnished Glass • Fish Paper — Mylar • Creped Kraft — Mylar • Aluminum or Copper Foil — Mylar • Mylar Capacitor Caps • "B" Stage Epoxy Coated Materials • Wide Range of Specialties

*Dacron—Du Pont's trademark for its polyester fiber. *Mylar—Du Pont's trademark for its polyester film.

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An extensive electric wire and cable program is being prepared.

In addition to a tour of Western Electric's Hawthorne Works, it is expected that papers will be presented on the following topics: Fluidized Bed Process for Insulating Wire; Properties and Processing of Ethylene Copolymers for Wire and Cable; Manufacture of Tinsel Conductor and Cords for Telephone Use; Aluminum Cable Sheathing by Direct Extrusion; New Developments in Wire Coating Materials; Continuous Casting Process for Aluminum Rod; Color Applications in the Wire and Cable Industry; Wire and Cable Materials and Extrusion; and Effects of Water Borne Impurities on the Insulating Resistance of PVC Insulation Materials.

ISO Plastics Committee to Meet In Prague, October 17-22

Nine working groups of technical committee 61 on plastics of the International Organization for Standardization will meet in Prague, Czechoslovakia, October 17-22. Their work will deal with the following: nomenclature and definitions; mechanical strength properties; standard laboratory atmosphere and conditioning procedures; thermal properties; physical-chemical properties; aging, chemical, and environmental resistance; preparation of test specimens; electrical properties; and specifications. Twelve American delegates from industry, government, and education are expected to attend the meeting. The United States holds the Secretariat of TC/61, in which 21 member nations of the ISO are participating.

EIA Radio Fall Meeting

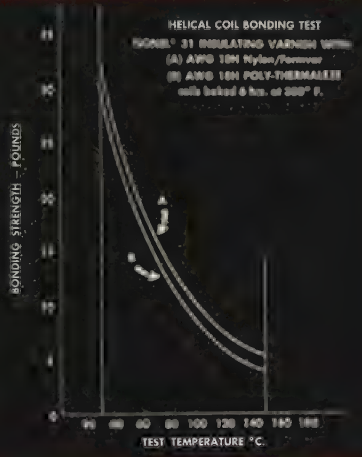
The 1960 Radio Fall Meeting, sponsored by the Electronic Industries Association and the Institute of Radio Engineers, will be held at the Hotel Syracuse, Syracuse, N. Y., on October 31 to November 2. As usual, it will be devoted entirely to the "home entertainment" aspects of the electronic industry rather than industrial and military electronics.

Advance registration material may be obtained from the EIA Engineering Office, Room 2260, 11 West 42 St., New York 36.

for complete compatibility with new
POLY-THERMALEZE-TYPE MAGNET WIRES

Check these characteristics

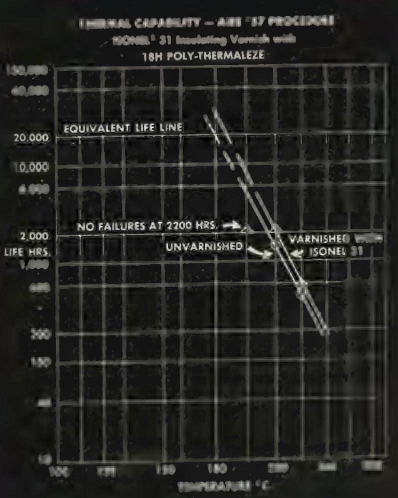
- Excellent Heat Life
- High Bond Strength
- Good Electric Strength
- Moisture, Chemical and Oil Resistance
- Complete Dip Tank Stability
- Contains No Injurious Solvents
- Provides Smooth, Uniform Build
- For Class A, B or F Applications



You can obtain maximum performance with POLY-THERMALEZE* and similar new multipurpose polyester magnet wires** with Schenectady's ISONEL® 31 Polyester Varnish.

Extensive tests in our Electrical Testing & Development Laboratory have demonstrated this versatile varnish is completely compatible with POLY-THERMALEZE-type wire enamels.

To illustrate, note the results of heat life and bonding strength tests shown in the graphs. Check list of ISONEL 31 characteristics too.



Then contact us or your Schenectady technical representative for a full discussion. We'll be pleased to work with you. Address your inquiries to Schenectady Varnish Company, Inc., Section E-40, Schenectady 1, N. Y.

* Trade mark. Phelps Dodge Copper Products Corp.

** Such as Poly-Thermalex by Essex Wire Corp., Anatherm D by Anaconda Wire & Cable Company, Isopol by Westinghouse Electric Corp., Poly-Beldtherm by Belden Manufacturing Co., Poly-F by John A. Roebling Sons Division

Insulating Varnishes and Wire Enamels — Since 1906

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Other plants in: Canada • France • Mexico

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General Electric RTV*
LIQUID SILICONE RUBBER

Cures at room temperature, useful from —70°F to +600°F

General Electric RTV silicone rubber compounds provide the dielectric properties of silicone insulation in a form well suited for potting, encapsulating, sealing and impregnating. Available in a wide range of viscosities from 120 to 15,000 poises, they do not shrink or form voids. RTV resists temperature extremes, moisture, ozone, weathering, aging and aircraft fuels. Applications include:

Potting and Encapsulating

RTV is used to pot whole electronic assemblies, while RTV encapsulation protects components from moisture, ozone, physical shock and high-altitude arc-over and corona. Also used as a conformal coating on printed circuits.

Transformer Impregnation

Impregnation with RTV assures top performance for aircraft transformers up to 250°C. Other materials failed due to poor high-temperature resistance or failure to penetrate tightly wound coils.

Cable Connection Potting

Connectors and junctions of high-temperature cable, such as missile wiring harnesses or industrial power and control cables in severe environment, are potted with RTV because of its ability to stand for long periods and then perform reliably when needed.

Longer Life for Motors

Electric motors last longer when stator windings are encapsulated with RTV. RTV's outstanding moisture resistance enables dripproof motors to meet certain applications which formerly required totally enclosed units.

*Room Temperature Vulcanizing.

For more information and a free test sample, write (briefly describing your application) to General Electric Company, Silicone Products Department, Section M1030, Waterford, New York.

GENERAL ELECTRIC

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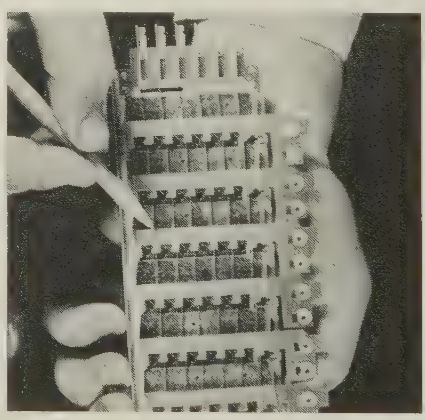
Close Tolerance Plastic Part

The problem of tolerance build-up in punched laminated plastic parts—the compounding of individual tolerances on several punched holes or cutouts over the length of the piece—is not the bugaboo that many designers believe, according to Taylor Fibre Co., Norristown, Pa.

As an example of how careful die work and good working knowledge of the material make it possible to minimize tolerance build-up, the firm cites a part made by James Cunningham, Son & Co. Inc., Rochester, N.Y., a manufacturer of intricate crossbar switches. These switches are three-dimensional multiple relays, with from 30 to 1200 switching contacts, which bring intelligence from as many as 600 sources to one or more readout or signal points.

An important part of this switch is an insulated pusher bar made of grade XXXP laminated plastic. Total tolerance build-up of six punched-out sections in the bar must be held to less than .002-inch.

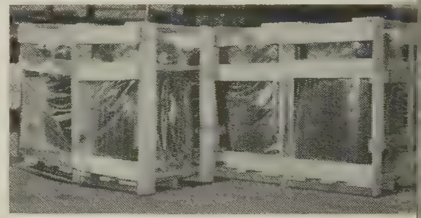
Previous materials used by Cunningham to fabricate the pusher bar proved difficult to hold to the close tolerances required. The success of the XXXP laminate is evidenced by two things, according to Cunningham: 1) *Marked reduction in supplier rejects*—100 percent inspection has indicated that the dimensional stability of laminated plastic exceeds that of some former materials by more than 50 percent. 2) *20 percent production gain*—With far fewer off-tolerance pusher arms, assembly is speeded and adjustment time in "fine-tuning" subassemblies is reduced.



Pusher arms are only 2.955 inch
long and .031-inch thick. The piec
must be held flat within ±.005 inc
and meet decimal tolerances of ±.00
with total build-up not exceedi
±.002. Parts are hot punched. Car
ful die design and a thorough know
edge of the thermal and other prope
ties of the material, plus experien
in fabricating close-tolerance wor
allow Taylor to meet the specific
tions.

Polyethylene Packages Transformers

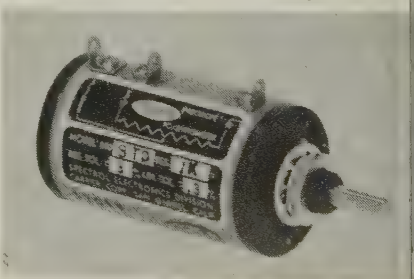
Electrical products of dissimil
sizes, ranging from large transforme
to minute electronic components, a
being packaged in polyethylene fil
Canton Containers Inc., extruders ar
fabricators of polyethylene film, r
cently designed and fabricated a pol



ethylene cover for a transformer ma
ufacturer, eliminating a shipping ar
storage problem. The transforme
shipped and stored in wooden palle
are packaged in polyethylene, locki
out moisture, dust, and dirt. Such a
solute product protection provides t
manufacturer with more warehou
area, since the transformers can
stored outside the warehouse.

Diallyl Isophthalate For Potentiometer

Rigid specifications for high-te
peratures in Spectrol Electronics Co
500 series precision potentiometers r
portedly were achieved by moldi

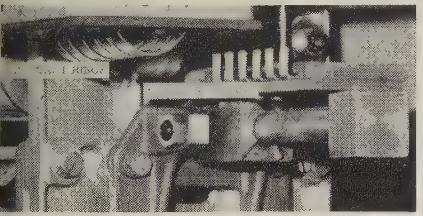


the casing of a material based on Food Machinery and Chemical Corp.'s diallyl isophthalate resins "Dapon M." In this instance, the Dapon M compound has an operating temperature of 500°F—some 50° to 100° higher than normal diallyl phthalate.

The model 500 is a 10-turn precision "pot" only ⅞-inch in diameter and is available in resistances ranging from 25 to 250,000 ohms with a standard linearity tolerance of ±0.25%. Its Dapon M case is claimed to provide rugged protection with excellent electrical properties, even under high humidity conditions.

Printed Circuit Keys Automate Processes

Now successfully in operation for an electrical appliance manufacturer, a new system for automated multi-process cycle selection and variation is directed and controlled by printed circuit key-card dispatching. Innumerable process variations reportedly can be automatically cycled in a single "Abbey-Matic" system (Abbey Process Automation Inc., Long Island, N.Y.) without manual assists.



The new printed circuit dispatch keys function as carrier guides and controls, utilizing various printed electrical circuit combinations to direct and activate movements of the carriers throughout the system. The key consists of two main components: a small, flat, rectangular base plate of sheet steel, and a printed circuit board of the same dimensions with flexible stainless steel contact-prongs at one end.

Keys are inserted on carriers at the loading point. As the carriers arrive at stations, the key-prongs make contact with matching contact-rings in the station receiver units. Course of action at each station is determined and initiated at that point. Keys can be identified by urocess name, number, or color.

FLEXITE®

HT105°C

extruded vinyl tubing

Here . . . try it! This is MARKEL HIGH TEMPERATURE TUBING, extruded of non-migratory polymeric-plasticized resins—a product from the *Line of Excellence*—Markel-made to meet these tough specifications for insulating (or mechanical and chemical) tubing:

● non-flammable; U/L-approved for applications up to 105°C ● dielectric strength, more than 700 v/mil ● tensile strength, 2700 psi ● low temperature flexibility, to —30°C ● oil resistance, flexible indefinitely when immersed ● crystal-clear in all sizes, #24 to 1½" ● colors, up to 10 standard in many sizes.

Try it; you'll stay with it. What do you need—Markel sample file? —prices? —test lengths? Call, write, or wire; you'll get action.

L. FRANK MARKEL & SONS
SINCE 1922

1 SOURCE *for* EXCELLENCE *in*
Insulating Tubings, Sleevings, and Lead Wire

NORRISTOWN, PENNSYLVANIA

Print Ins. 31 on Reader Service Card

HIGH HEAT INSULATION ?

Scorching temperatures are no problem for electrical and electronic ceramics made by The Electrical Refractories Co. Ceramics can be made to meet your toughest electrical, physical, and thermal requirements. Standard and special

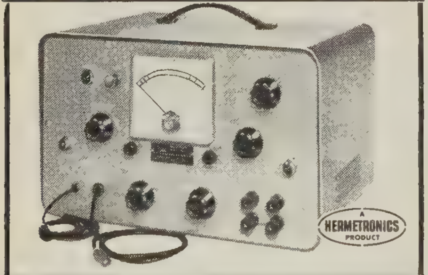
Tubing, hangers, guides, simple or complex shapes and parts.

Ask for Free Descriptive Folder

THE ELECTRICAL REFRACTORIES CO.
East Palestine, Ohio

Print Ins. 32 on Reader Service Card

GHS MEGPOTS* for Non-Destructive Testing
*TM. GHS CORP.



MEGPOT MEGOHM-METER AND HIGH POTENTIAL TEST SET

Non-destructive testing assured through quick acting relay, cuts current from tested components in milliseconds. Provides for continuously variable leakage test, with settings from 20 microamperes to 3 milliamperes. Reduces costs substantially for testing transformers, relays, capacitors and complete assemblies. Rugged, portable.
Voltage Ranges: Variable ranges to 0-5000V avail.
Megohm-Meter Ranges: Up to 4 million megohms at 100 or 200V DC, up to 10 million megohms at 500V DC.
Size: 16¼″ wide x 10½″ high x 12¼″ deep.
Weight: 26 lbs. BULLETIN No. 158

MEGPOT HIGH POTENTIAL TEST SET

Lightweight portable for non-destructive testing. Full scale output with 0.0025 mfd load capacitance.
Voltage Ranges: Variable ranges to 0-5000V avail.
Size: 11¼″ wide x 8½″ high x 9⅛″ deep.
Weight: 12 lbs. BULLETIN No. 570

Write or call today for literature.

GENERAL HERMETIC SEALING CORP.
GHS electronics
99 E. HAWTHORNE AVE.
VALLEY STREAM, L.I., N.Y.
VAlley Stream 5-6363

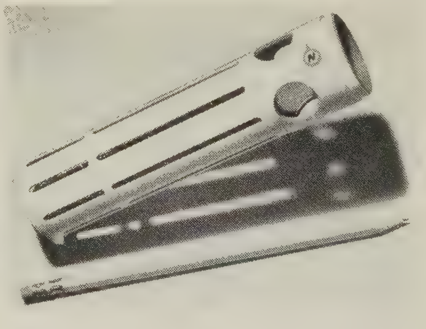
Print Ins. 33 on Reader Service Card

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card —no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

Laminated Fiber Glass Machined to Close Tolerances by New Process

Specialized laminated products or components for electrical/electronic uses are produced by a new method of machining silicone glass, epoxy, polyester, and polystyrene. The new process utilizes specially designed routers and indexing fixtures. Closer tolerances and greater uniformity reportedly can be maintained by the semi-automatic process which is expected to provide lower unit costs. The coil form for the RF antenna coupler shown in the accompanying photograph is typical of the items which can be manufactured. Special Products Div., National Connector Corp., 311 Fifth Ave. North, Minneapolis 1, Minn.



Print No. Ins. 101 on Reader Service Card

Rigid Urethane Foams

New "CoRezyn" PEF-2000 and 2003 are resins for producing rigid polyurethane foams for use as insulation for appliances and other applications. PEF-2000 is a polyether resin prepolymer, and PEF-2003 is a catalyst-propellant mixture. The propellant is trichlorofluoromethane. Closed-cell foams of various densities may be formed by mixing the proper proportions of the two foam-in-place materials. Data sheets available. Commercial Resins Corp., 594 James Ave., St. Paul 2, Minn.

Print No. Ins. 102 on Reader Service Card

New High Dielectric Glass Polyester Premix

A new fiber glass reinforced polyester molding compound, grade 1703 premix, reportedly features excellent dielectric strength, particularly in thin sections. It is also said to have the good impact strength and dimensional stability, low water absorption, and excellent arc resistance typical of glass-polyester. Other properties claimed include excellent thermal stability, compatibility with other insulating materials, high corona starting voltages, and good moldability. Additional information and samples available. The Glastic Corp., Molding Materials Div., 4321 Glenridge Road, Cleveland 21.

Print No. Ins. 103 on Reader Service Card

Flame-Retardant Glass-Epoxy Laminate

A new flame-retardant material recommended for printed circuit and other electronic applications, grade FR-4, is a glass-base laminated plastic with an epoxy resin binder. Grade FR-4 has qualities similar to Grade G-10, a general-purpose type of glass-base epoxy, and Grade G-11, a high-temperature type of glass-base epoxy. All three laminated plastics, designed for printed circuit and electronic applications, reportedly possess extremely high mechanical strength at room temperature and good dielectric loss and dielectric breakdown properties under both dry and humid conditions. FR-4 is also said to meet all the mechanical and electrical requirements of MIL-P-18177B, Type GEE. It is available in sheets, rods, and tubes, and can be furnished with copper cladding on one or both sides in standard foil thicknesses. The copper clad laminate meets the requirements of MIL-P-13949-B, Type GF. Synthane Corp., Oaks, Pa.

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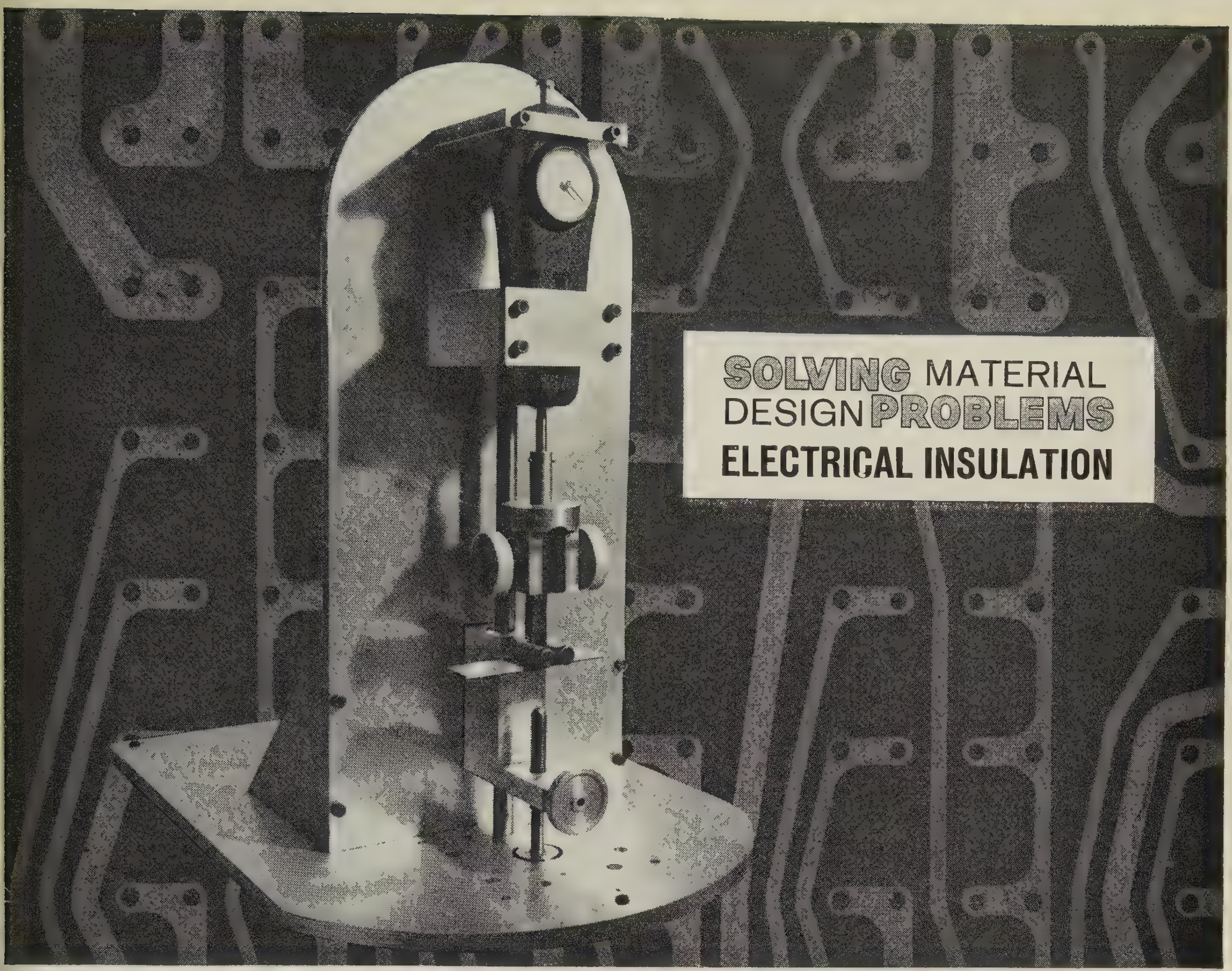


CDF's Di-Clad® printed circuit boards are tested for bond strength in this precision machine.

CDF offers you superior plastic insulating materials: copper clad laminates for printed circuits, epoxy resin plastics, phenolic-impregnated materials, Micabond® bonded mica insulation and vulcanized fibre.

The CDF line is the widest now available . . . and meets every major civilian and military specification.

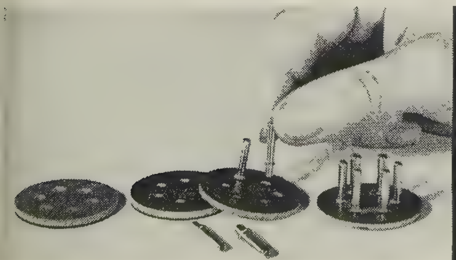
We may also be able to save you time, money and headaches with other CDF services. Skilled, experienced personnel using modern equipment will form, machine, and mold plastic parts to your specifications.

Top CDF engineers will work with your production and design people, in your plant, on problems plastics can solve. CDF research works constantly to develop new and improved plastics.

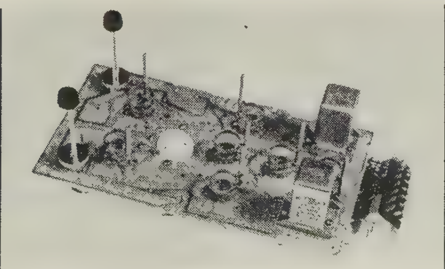
In short, CDF offers you complete service in plastics: materials, custom fabrication, engineering aid, and research. Please ask your CDF Sales Representative about our materials and services the next time he calls on you. If you prefer, write directly to our Technical Service Department.

CONTINENTAL-DIAMOND FIBRE

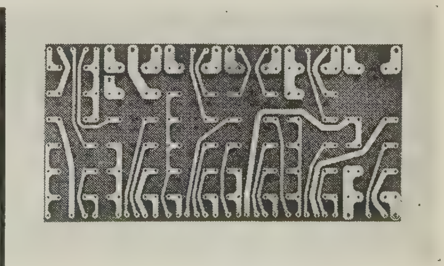
A SUBSIDIARY OF THE Budd COMPANY • NEWARK 17, DEL.
In Canada, 46 Hollinger Road, Toronto 16, Ont.



Vibration-free plug bases, fabricated by CDF. A special bond of CDF Dilecto® laminated plastic and rubber.



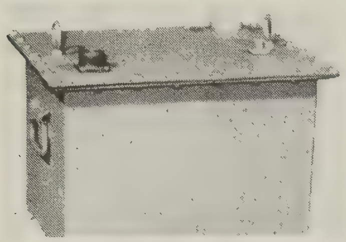
High reliability printed circuits for military applications. Made from CDF's glass-base Di-Clad laminated plastic.



Low-Cost commercial circuits. Made from CDF's paper-based Di-Clad copper-clad laminate.

Print Ins. 34 on Reader Service Card

50,000 Volt DC HV Test Set



- Small size, light weight
- Rugged & reliable
- Low cost

Model S50-5DC is designed for dielectric testing, for leakage current measurements at high-voltage, and also used as a high voltage power supply for CRT work, electrostatic processes, sparking, corona generation, etc.

The oil-filled tank, less than 1 cu. ft. in volume, contains all HV components, metering facilities and automatic output shorting solenoid.

Selenium rectifiers are employed for ruggedness, long life and enhanced reliability. HV terminates in a shielded cable.

A fully instrumented control panel in cabinet or for rack mounting, not shown, provides all safety and convenience features.

The HV section pictured also available by itself without the control cabinet for use as a power unit.

Many other models available.

Telephone or write.

Peschel Electronics, Inc.

Phone TRinity 8-3251
Towners Patterson, N.Y.

Print Ins. 35 on Reader Service Card

HIGH TEMPERATURE THERMAL INSULATION COATING

PT-209!

FAA approval given for thermal resistance on aircraft landing doors. Test made with 15 mil coating of PT-209 on .025 aluminum. Thermocouples on both sides. On continuous basis, coated side exposed to butane flame was 2000°F; other side, 800°F.

Cross-sprayed with conventional gun —15 mils per coat; graduated thermal curing required. Cured coating properties:

Adhesion—Excellent
Taber-Abrasion—670 cycles per mil w/CS-17 wheel—1000 gram load
Thermal Shock—Good
Thermal Expansion—11.2x10⁻⁶ in/in °C. from 25°C. to 700°C.
Oil Resistance—Mil 7808, 6 months; Skydrol, 100 hours
Water Resistance—6 months room temp. & 180°F.
Dielectric Properties—Excellent
Thermal Resistance—6000°F., 15 sec. (carbonizes), 2000°F., continuous
Flame Resistance—2000°F.
Thermal Conductivity—Kc-600°F.—1.8 (BTU/hr/Ft/2/°F./in.), Kc-900°F.—2.2

Want more information — prices — data sheets for your files? Please write . . .

PRODUCT TECHNIQUES INC.
Problem-Solving Specialists
511 EAST 87th PLACE
LOS ANGELES 3, CALIFORNIA

Print Ins. 36 on Reader Service Card

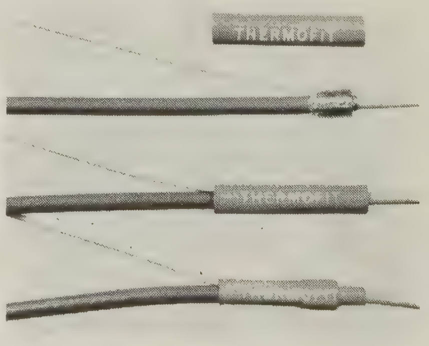
Polypropylene Clamps for Electrical/Electronic Uses

New loop type clamps made of polypropylene may be used as a wire and cable clamp, transformer lead clip, strain relief, tube and pipe hanger, etc. They are recommended for general use, indoors or outdoors, in many applications in electronics, electrical wiring, communications, machinery of all kinds, appliances and lighting equipment. The "Hi" clamps open to various diameters for easy application, and are held in place by a single rivet, screw, or bolt. It is claimed that they are exceptionally tough. Properties reported include high tensile strength and great rigidity; excellent dielectric properties, even at high frequencies; resistance to solvents, grease, oil, and many common acids and chemicals; and a temperature range of —20°F to 220°F (—28.9°C to 104°C). They are molded with smooth round edges. Samples available. Holub Industries Inc., 430 Elm St., Sycamore, Ill.

Print No. Ins. 105 on Reader Service Card

Irradiated Sleeving Shrinks Over Connectors, Splices, Harness Bundles

A new irradiated insulation sleeving, called "Thermofit," shrinks tightly over complex contours to a permanent specified size when exposed to heat. It is supplied with an expanded diameter for easy slip-on application over connectors, splices, or harness bundles. Heat at 235°F or above for 3-to-5 seconds causes the material to return to the precise diameter determined before it was expanded. Other properties of the sel extinguishing and thermally stabilize sleeving reportedly include: no mel ing or cold flow; minus 100° (—73.3°C) without brittleness; re sistance to acids, alkalis, aviatio fuels, and hydraulic fluids; inert t fungus; high abrasion resistance dielectric strength of 800 vpm of wa thickness; and 1.28 specific gravity It is supplied in five standard color in 4-ft lengths (any length or colo on special order). It can be marke for coding and identification. Stand ard ID sizes after shrinking rang from .027″ to 2.070″. Complet specifications and test reports ar available. Raychem Corp., Oakside a Northside, Redwood City, Cal.



Print No. Ins. 106 on Reader Service Card

Vinyl Electrical Tape Works at —20°F

A new vinyl electrical tape reportedly strips easily, remains flexible never freezes, and sticks down a —20°F. The working range of "Slipknot" CW is from —20°F to +120° (—28.9°C to +49°C) and the con formability is stated to be far beyon anything else in the field. The tap is 8½ mils thick—slightly heavie than the standard Slipknot No. 7. I is marketed only in 66-ft rolls a present. Plymouth Rubber Co. Inc Canton, Mass.

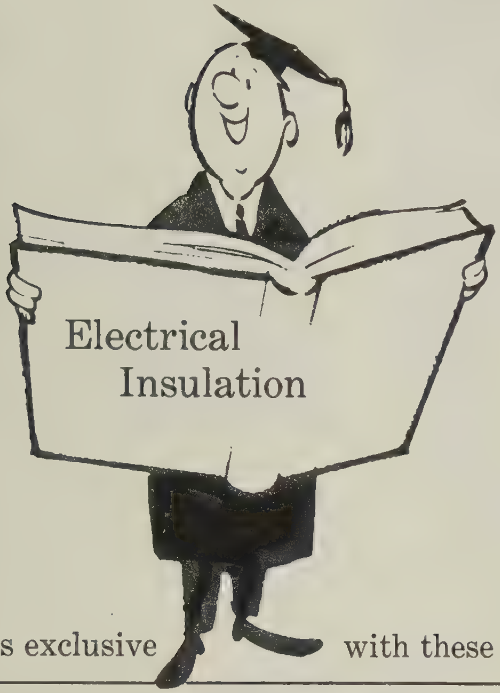
Print No. Ins. 107 on Reader Service Card

Silicone Rubber Insulating Tape Aids Level Wrapping

A new line of self-adhering un supported silicone rubber insulatin tapes, designated CDF Level-Wra tapes, feature triangular cross section that permit them to be readily woun on irregular shapes. Each tape is a thick at its apex as the required tota insulation thickness. When wrappe in overlapping halves, the tapes giv smooth, even external surfaces.

"E" quality—spells—

the finest weave *(thickness .0045")* in Fiberglas* tape



E *is excellent for*

High tensile strength

High cloth count insures complete and uniform glass coverage over area of fabric.

Highest quality glass tape made with "D" fiber yarns

Good handling and winding qualities

E *is essential*

Where price is not the deciding factor but the best electrical results are required.

E is exclusive with these distributors

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ELECTRICAL INSULATION SUPPLIERS
500 Means Street, N.W.

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1231 Superior Avenue, N.E.

COLUMBUS, OHIO
NATIONAL ELECTRIC COIL
Division of McGraw-Edison Co.

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SUMMERS ELECTRIC COMPANY
1302 So. Good-Latimer Expressway

DAYTON, OHIO
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ROBERT McKEOWN COMPANY INC.
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MITCHELL RAND MFG. CORP.
Insulation Division, 51 Murray St.

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EARL B. BEACH COMPANY
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EARL B. BEACH CO.
Verona & Mt. Carmel Rds.

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SEATTLE, WASHINGTON
WESTERN FIBROUS GLASS PRODUCTS CO.
1915 First Avenue S.

ST. LOUIS, MISSOURI
WHITE SUPPLY COMPANY
4343 Duncan Avenue

Horace Linton Division
HESS, GOLDSMITH & CO., INC.
1400 Broadway, New York 18, N. Y. A Division of Burlington Industries

Makers of Quality Fiberglas Tapes . . . including HESGON

Burlington
QUALITY

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for
high temperature
magnet wire

Unusual opportunity for sales representation in some territories of the U.S.A. to handle a full line of high temperature magnet wire produced by a leading manufacturer. Please provide information on the territories which you cover as well as other product lines handled.

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protect . . .
conserve space . . .
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MICA

One of the best dielectrics known!

- High heat resistance and dielectric strength
- Chemically inert—non-hygroscopic
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We'll be pleased to answer your questions about the properties of mica or its use in specific applications. There is no obligation. Send for FREE booklet: "Natural Mica For Industry."

Mica Industry Association, Inc.
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New York 17, N.Y.

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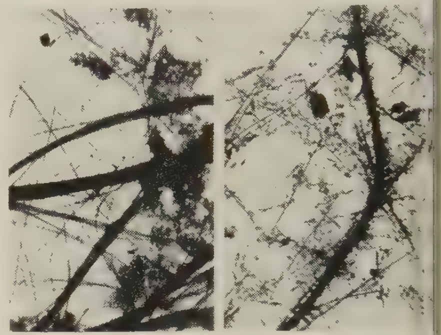
colored center line guides the wrapping and overlapping. Other features claimed are excellent thermal stability, corona resistance, moisture resistance, high resiliency, and thermal conductivity. Eight standard grades range from 1″ to 1½″ in width and from .020″ to .080″ thickness at the apex and .007″ to .008″ thickness at the edges. Continental-Diamond Fibre Corp., a subsidiary of The Budd Co., Newark, Del.

Print No. Ins. 108 on Reader Service Card

Fluorocarbon Gasketing Material for High Temperature Electrical Uses

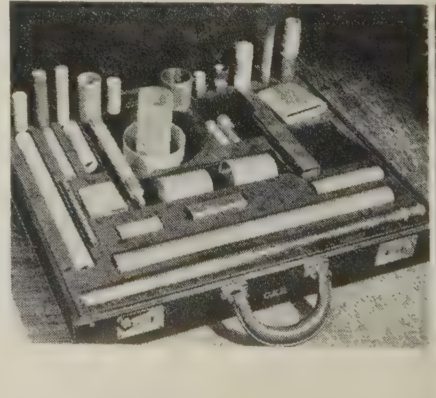
A new family of gasketing and packing materials made of fluorocarbon resins and inorganic fibers reportedly can be used at temperatures from −425°F to +500°F (−261°C to +260°C) with excellent torque retention and are unaffected by fuels, lubricants, hydraulic fluids, or solvents common to many industrial processes. They can be used in the electrical industry as gaskets for high temperature ("H" type) equipment including dry transformers, converters, circuit breakers, motors and switches, and terminal bars and spacers. The new sheet materials, called Accopacs, are said to be inert to most chemicals over a wide range of temperatures and to have a low coefficient of friction. Good dielectric properties and excellent thermal dimensional stability are claimed. They can be adhesively bonded to other materials with either thermoplastic or thermosetting adhesives by merely sanding the face that must be bonded with fine sandpaper and applying the adhesives. The manufacturer states that their outstanding resistance to deformation under load and resistance to cold flow or creep is not equaled by any other fluorocarbon material. Accopacs are combinations of fluorocarbon resins and asbestos or other inorganic fibers in different proportions and different densities. They are made by a patented beater saturation process which uniformly coats each inorganic fiber and distributes the fibers evenly to form a uniform material that is said to overcome many of the deficiencies of straight fluorocarbons. Electron microscope photos show (left) slurry made by conventional beater saturation process and (right) slurry made by the patented beater saturation process. Armstrong Cork Co., Lancaster, Pa.



Print No. Ins. 109 on Reader Service Card

Round Glass Fiber Reinforced Plastic Tubing in 27 Sizes for Insulation

Round "Red Thread" glass fiber reinforced plastic tubing for a wide range of electrical applications is now available in 27 ID sizes with no tooling charges. In the past, the customer customarily assumed cost of tooling charges for these sizes. The 27 standard sizes include the most popular internal diameter sizes in the ½″ to 6″ range with wall thickness ranging from .03″ to 1⅝″. Lengths are available up to 20 ft. Special sizes of tubing in round, square, and rectangular shapes are available on a custom basis. Electrical uses include plain and combination tubing for fuse tubes, fuse cores, bus bar tubing, solenoid frame spacers, and coil forms. Literature available. Rein-



forced Plastics Div., A. O. Smith Corp., 3533 N. 27th St., Milwaukee 1, Wis.

Print No. Ins. 110 on Reader Service Card

Spray-On Epoxy for Electrical And Corrosion Protection

Easily applied protection can now be provided for pipe fittings, supports, and other objects by spray application of "Scotchkote" brand protective resin No. 101, a one-part powdered 100% epoxy resin. The tough, thin coating gives pipe hardware the physical and electrical protection of a true epoxy, and is claimed to be the first practical means of applying corrosion protection to fittings prior to their arrival in the field. Sprayed on heated parts with a flocking gun, the resin flows evenly to give a uniform, smooth coating which cures in less than 60 seconds. The complete protection of complex fittings such as leak clamps and couplings has long been a problem for utilities, transmission companies and chemical plants. The protection of these fittings, as well as all other types, can be accomplished at the convenience of the user, in the shop. Scotchkote 101, when cured, is completely thermoset, and will not flow under pressure nor flow upon heating. It is said to have an adhesive strength of more than 3,000 psi and high impact resistance, and to resist attack by most chemicals, including hydrocarbons such as fuel oil, gasoline, kerosene, and sweet or sour crude. Typical resistance value of a 10 mil coating is 10,000 megohms per sq. ft. Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

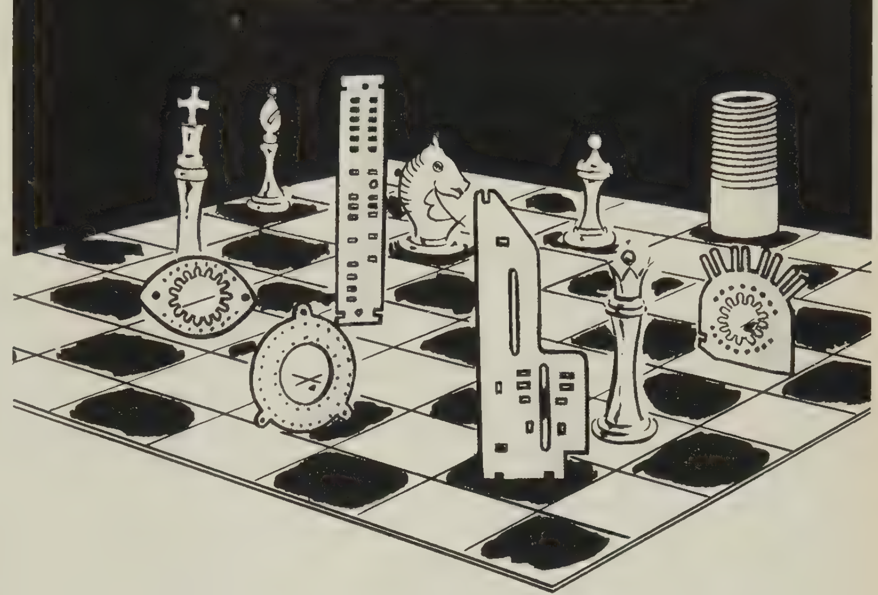
Print No. Ins. 111 on Reader Service Card

New Insulating Rod Shapes

Nine new shapes have been added to a line of electrical insulating rod. The fiber glass reinforced polyester extruded rod is designed for applica-

checkmated for new material ideas?

INSUROK® has "ACROSS-THE-BOARD" WINNING CHARACTERISTICS



Richardson laminated and fabricated parts outperform many other materials used in the electrical/electronic fields because of their unique and different combinations of desirable plastic properties. In special degrees, INSUROK grades have: (1) Low dielectric loss. (2) Low moisture absorption. (3) Flame retardance. (4) High insulation resistance. (5) High strength, etc.—all these provide design flexibility and comply with the most rigid specifications.

Richardson manufactures a complete line of INSUROK laminated grades to meet a great many design needs for government or commercial applications. Many copper clad grades are available.

You can count on Richardson to work with you in selecting the right grade to fit your specific component requirements. Complete integration of manufacturing and fabricating facilities assure precise, accurate parts. Investigate INSUROK today. Richardson also custom molds a wide range of parts for consumer and industrial products. Call your nearest Richardson Branch Office, or write direct.

THE RICHARDSON COMPANY
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Laminated
Fabricated
and
Molded
Plastics

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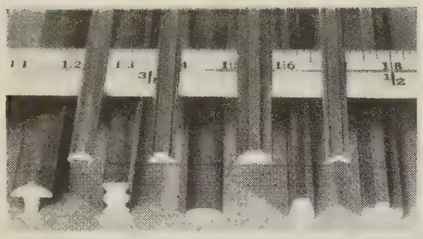


tions requiring insulating structural, mechanical, or spacing members—push rods, actuating linkages, clamping blocks, tie bars, bracing members, stator cell U-wedges, and spacing sticks in dry-type transformers. The polyester rod has a continuous fiber glass filament that runs through its entire length for high strength. A 130° — 150°C material, it is said to have arc resistance (150 sec., ASTM D-495), low moisture absorption (0.4% maximum), and excellent dimensional stability under conditions of heat and humidity. Engineering data, prices, and samples available. The Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio.

Print No. Ins. 112 on Reader Service Card

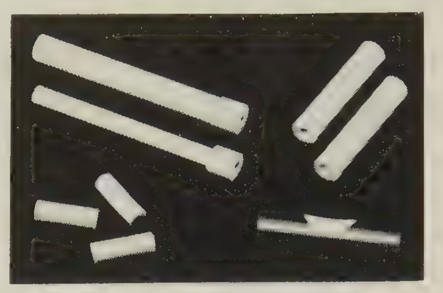
Vinyl Tubing Shrinks Over Wires, Connections, and Components

Special vinyl tubing which, when cured, contracts tightly around the encased wires, is used to provide assemblies with the characteristics of custom-made cable. The tubing is also available cut to desired lengths with special instructions provided for those assembling their own harnesses. The new sleeving can also be pre-stamped with cable identification as specified for cable and wire markers. Simple installation instructions are provided. Other uses of the pre-cut lengths include sleeving over terminals and wire connections, protecting small irregularly shaped components, and insulation of any material where a tight fit is necessary. Foley Electronics Co., Electrical Assemblers Div., 4810 Calvert Rd., College Park, Md.

Print No. Ins. 113 on Reader Service Card

Glass-Bonded Mica with 10-18 Micro-Inch Finishes

A special grade of glass-bonded mica, "Mykroy" 1116, can be finished to 10-18 micro-inch finishes for smooth potentiometer coil forms. It can be used by design engineers requiring exceptionally smooth, dimensionally stable coil forms for small wires in instrument manufacture, and in radio and electronic systems production. The smooth finishes are said to allow 0.0003″ wires to be wound smoothly and evenly, so that a brush riding across the winding will not bump or chatter. Since the coefficient of thermal expansion of the glass-bonded mica is the same as that of stainless steel, the dimensions of the mandrel when subjected to high operating temperatures change equally with those of the wire. The material reportedly withstands operating temperatures up to 1000°F, and has excellent electrical characteristics—low loss factor and dielectric constant, and high volume resistivity. Mykroy 1116 is available as centerless ground solid rods or short tubular forms with minimum wall thickness of 0.070″, and in tapered or saddle types of forms as custom-machined parts. Electronic Mechanics Inc., 101 Clifton Blvd., Clifton, N.J.



Print No. Ins. 114 on Reader Service Card

Single Skirt Bus Insulators

New bus insulators with single skirt design reportedly give improved dielectric resistance and greater creep distance than old style corrugated or straight sided insulators. The "Polyglas" insulators are also said to cut costs and reduce weight through the improved design. Other advantages claimed are: 1) Parting line is perpendicular to creep path and flashover, reducing possibility of dirt build-up and resulting potential trouble source. 2) Single skirt construction insures dry inner surface to reduce possibility of wet shorting. 3) Class B temperature range material. 4) Arc resistance is over 20 times greater than molded reinforced phenolic type insulators. 5) Reduced weight requires less freight on materials and provides easier handling. Polyglas Div., Pittsburgh Electrical Insulation Co., Box 10836, Pittsburgh 36, Pa.

Print No. Ins. 115 on Reader Service Card

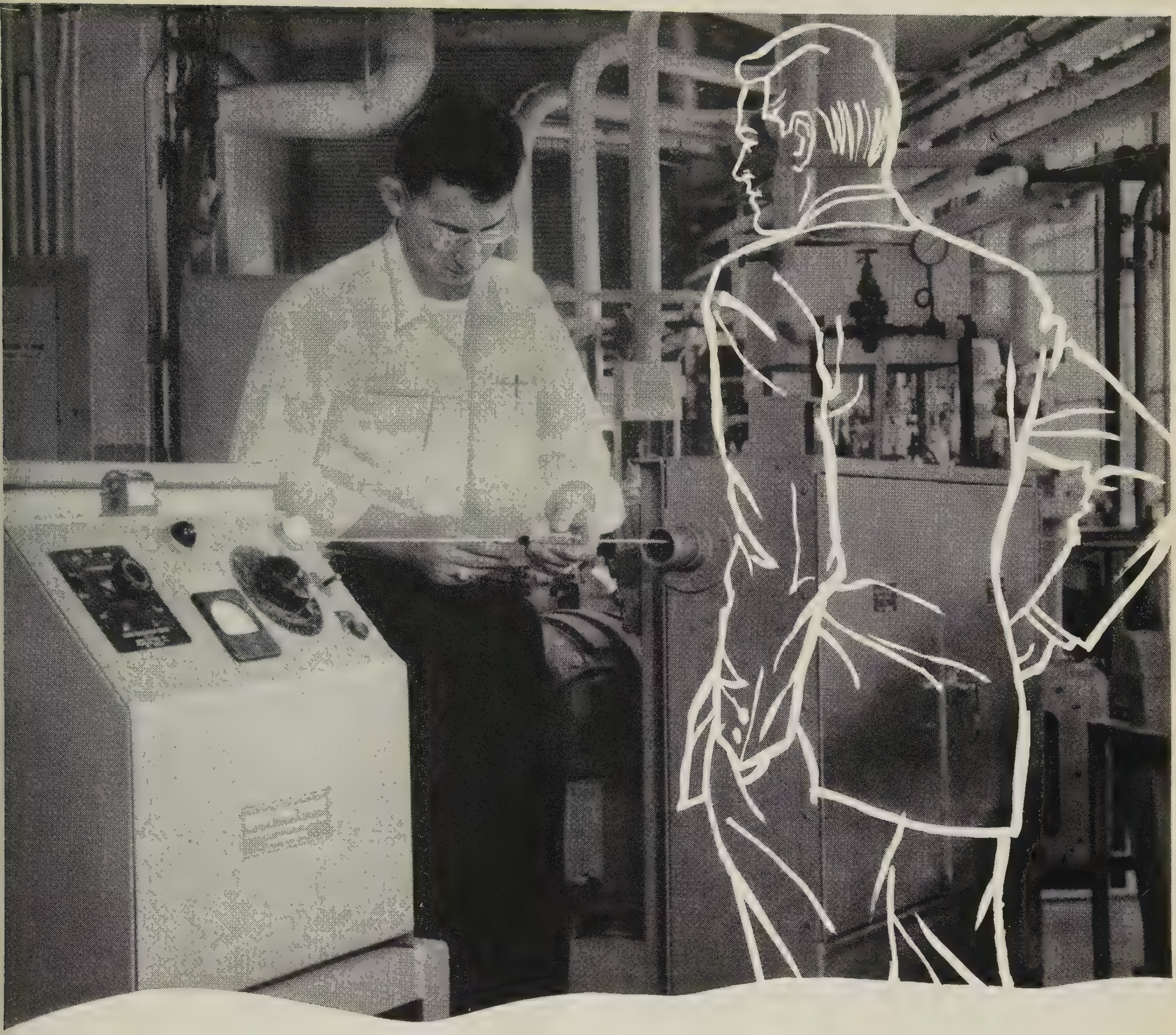
Liquid Vinyl for Electronic Repairs

A liquid vinyl, "Vyna-Kote," has been developed for use in custom wiring and harness operations. It may be applied by brush or dipping and dries almost instantly to form a film that reportedly has high insulating qualities. Some of its many applications include repair of soldering iron burns on wire insulation, insulating splices, repair of insulation creep-back at solder joints, preventing ravelling of the end of shields, coating terminals to avoid corrosion and accidental shorts, cementing crossovers, preventing leads from splitting off at breakout points, sealing up harnesses that are tied with vinyl cord, protecting code numbers on vinyl identification sleeves and fixing these sleeves to vinyl wires for maximum visibility, and encapsulation of small resistors and capacitors. Data sheet available. Spectra-Strip Wire & Cable Corp., P. O. Box 415, Garden Grove, Cal.

Print No. Ins. 116 on Reader Service Card

RTV Silicone Rubbers and Epoxy-Silicone Rubber Combination

New room temperature vulcanizing (RTV) silicone rubbers and epoxy-silicone rubber combinations are said to feature electrical excellence, particularly at elevated temperatures. Eccosil 4640 is a silicone rubber formulation which is extremely low in weight. Eccosil 4712, an epoxy-silicone, is stated to be particularly useful in cable connector potting and to retain flexibility after heat aging for prolonged periods at 450°F (232°C). Other materials in the Eccosil line are: 4850, a general purpose RTV silicone rubber for use to 600°F (316°C) in potting, caulking, and mold making; and 4520, a low viscosity epoxy-silicone impregnant and potting compound for transformers,



TWO NEW SOLUTIONS FOR "HOT" WIRE PROBLEMS

...FROM YOUR SILICONES MAN

Two new low shrink silicone rubber insulating compounds ... developed by the UNION CARBIDE Silicones Man ... are now solving many of today's electrical wire and cable insulation problems. Offering good dielectric and physical properties with easy processing, they are ideal materials for air frame applications, motor truck wires, motor leads and hook-ups, small appliance wiring, and marine wiring.

UNION CARBIDE K-1347 Silicone Compound is a premium quality stock that meets tight military and industrial specifications. It has high green strength, remilling is easy, and it is readily colored for coding. Easily extruded, it provides a smooth, non-porous, high gloss surface, and can be braided without postcure. Physical properties are excellent using either steam or hot air cures.

For economy operations where good, but not premium, physical properties are needed, lower cost UNION CARBIDE K-1357 may well fill all requirements. Available precatalyzed in both slabs and coiled strips, it can be fed directly from carton to extruder on most equipment.

Both silicones have outstanding retention of tensile strength and elongation after prolonged exposure to high temperature. Both have dielectric strength of 1000 volts/mil. Both can be cured with either steam or hot air. And both are low shrink compounds. K-1347 ... for premium properties. K-1357 ... for economy.

For more information, write or call your UNION CARBIDE Silicones Man, or Dept. EI-9905, Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *(In Canada:* Bakelite Company, Division of Union Carbide Canada Limited, Toronto 7, Ontario.)

UNION CARBIDE SILICONES

Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

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coils, etc. Emerson & Cuming Inc., Canton, Mass.

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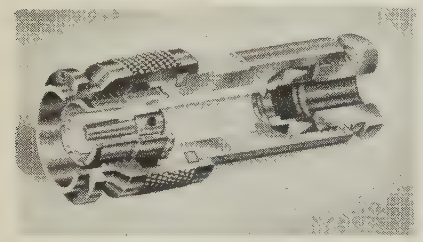
High Reliability RF Connectors

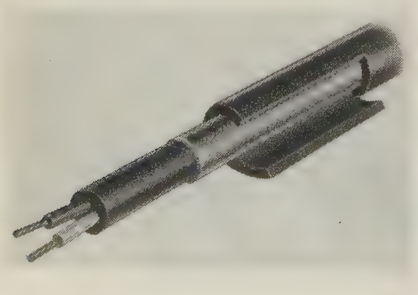
Designed for use with small size coaxial cables such as RG-59 B/U, a new series of "AN/MS" type connectors is said to be the first available line of connectors of this type to use irradiated polyolefin and polypropylene—both less costly than the more commonly used fluorocarbon materials. Weatherproofed and designed for extreme reliability, even under abnormal conditions of stress, the connectors reportedly may be efficiently used up through microwave frequencies with a minimum of line unbalance or increase in standing wave ratio. Design permits the coax conductor to be soldered directly to the contact point within the connector body, greatly reducing the danger of accidental disconnection due to cable strain. Available in impedances of 50 and 75 ohms. Maximum voltage rating up to 2500 v. Available in various lengths for cable connection or panel mounting. National Connector Corp., 311 Fifth Ave. North, Minneapolis 1, Minn.



Print No. Ins. 118 on Reader Service Card

Severed Underwater Cable Resists Longitudinal Pressures to 1,000 PSI

A new cable construction reportedly prevents the passage of water through the cable from one compartment to another, even though the cable be severely damaged or cut on the seaward side of the bulkhead. The exposed end is said to withstand 1,000 lbs/sq inch in conformance with the hydrostatic test of MIL-C-915A, Amendment 8. Multiconductor and coaxial constructions are available for submarines and all deep water applications. These cables have recently been released for sonar and the Anti Submarine Warfare Program. Boston Insulated Wire & Cable Co., 25 Bay St., Boston 25, Mass.



Print No. Ins. 119 on Reader Service Card

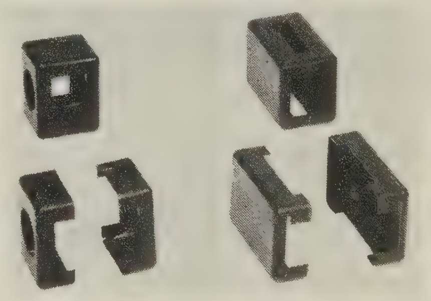
Silver-Nickel Plated Conductors

Silver-nickel plated copper conductors reportedly have the high temperature protection of a nickel coat, and the excellent solderability of silver. The new double-plated construction is available in full AWG ranges of single end and stranded conductors. Samples and data available. Hudson Wire Co., Ossining Div., Ossining, N.Y.

Print No. Ins. 120 on Reader Service Card

Glass-Epoxy Transformer Cases

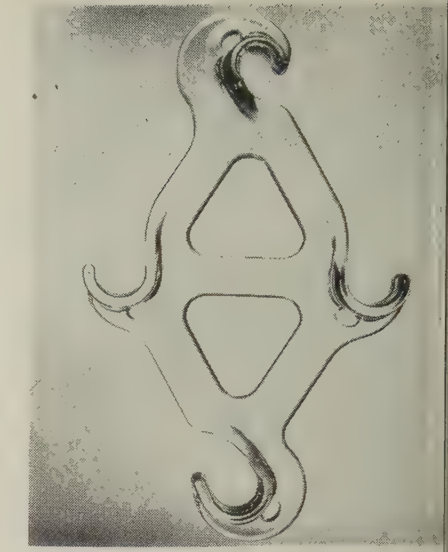
New glassy-epoxy laminated cases can be used to eliminate metal cans or potting molds in the encapsulation of high temperature transformers. The two halves are bonded together with the winding enclosed and the case is filled with potting compound. This procedure is said to reduce steps in potting, reduce weight of the unit, and eliminate rejects due to thin spots. Thin wall, glass reinforced, laminated cases are available in all temperature classes and tooled for specific applications. Stevens Products Inc., 86-88 Main St., East Orange, N.J.



Print No. Ins. 121 on Reader Service Card

Spacers for Transmission Systems

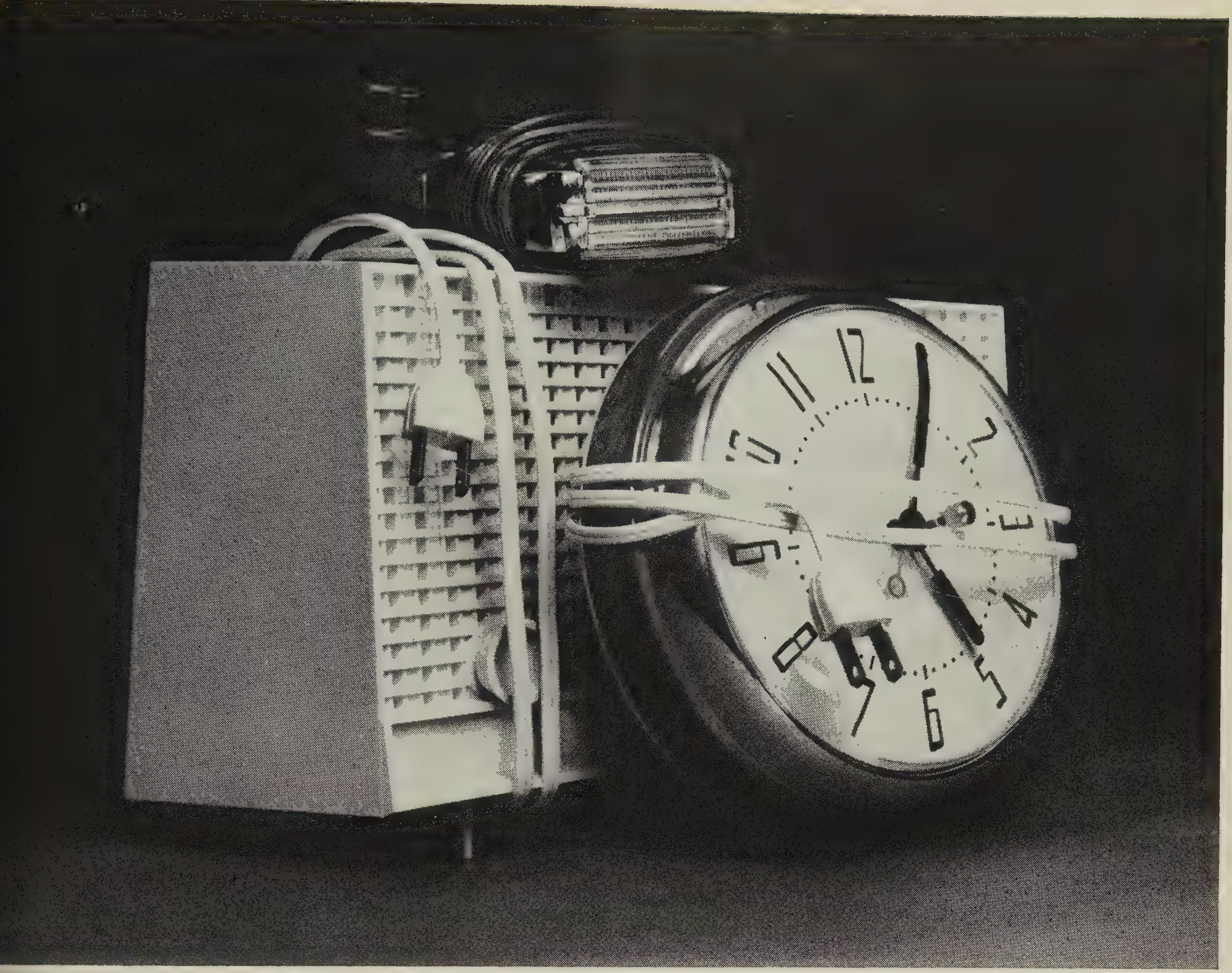
An economical electrical transmission system, designated Spanway, consists of one to three-phase conductors, messenger, and plastic spacers and is capable of carrying conductors up to 400 Mcm and voltages up to and including 15 kv. The spacers molded of an acrylic plastic with hig resistance to weathering and tracking hold the phase conductors in a 6 triangular configuration supporte from the messenger. Each spacer als acts as an insulator and so reduce the conductor covering thickne necessary to prevent voltage break down. The compact, lightweigh spacer features low leakage and hig corona levels when exposed to we atmospheric conditions. The singl size, approximately 7¾" to 13", ma be used for 5 kv to 15 kv installation The possibility of surface contamination on the spacer is low because c its one-piece construction, smoothl rounded edges, and lack of dirt-catching flat horizontal surfaces and reinforcing ribs. No grommets, nut bolts, or locking rings are require in installation and the lineman need only to make a familiar wire tie t provide a no-slide connection. Dep EFL, Anaconda Wire & Cable Co., 2 Broadway, New York 4.



Print No. Ins. 122 on Reader Service Card

Circular, Multi-Contact Connectors For High Environments

New circular multi-contact electr cal connectors designed for extrem environments have been designate series 600, 700, and 800. The ne connectors are designed to meet MI C-26500, which covers the high-alt tude, temperature, and shock require ments of rockets, missiles, and spac vehicles. They reportedly are immersion-resistant; withstand 50 hours c salt spray, 50-g shock, and 500° (260°C) for 1000 hours; and wi



Making vinyls safe for contact with polystyrene

Would it be safe to leave these polystyrene cases wrapped in *your* vinyl-insulated wire? Or must you warn your customers against the perils of plasticizer migration?

There's one plasticizer you don't have to worry about . . . Rohm & Haas PARAPLEX G-54. PARAPLEX G-54 *stays* in vinyls. It gives your compounds excellent resistance to plasticizer migration into polystyrene, enamels, and acrylic plastics. There's no marring of finishes, no crazing of plastics.

PARAPLEX G-54 has other advantages, too. In a vinyl compound, it promotes outstanding retention of physical properties on exposure to high temperatures, imparts good resilience, resists extraction by oils, greases and soapy water, has good compatibility at high-temperature, high-humidity service conditions.

For heat and light stabilization, PARAPLEX G-54 produces excellent results in combination with the epoxy plasticizer PARAPLEX G-62. If peak electrical performance in vinyl insulation is your goal, you should also evaluate MONOPLEX S-90E.

Get complete technical information by writing for a new 23-page brochure, *Physical and Performance Properties of* PARAPLEX *and* MONOPLEX *plasticizers.*

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Chemicals for Industry

ROHM & HAAS
COMPANY
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

PARAPLEX G-54

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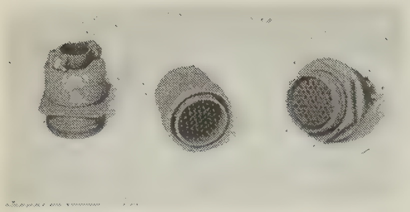


handle 1500-volt rms potentials at sea level. The new connector is available in 24-, 31-, or 55-contact configurations. Insulator blocks are of high-strength, glass-filled diallyl phthalate. Electro Mechanical Instrument Div., Consolidated Electrodynamics Corp., a subsidiary of Bell & Howell Co., 360 Sierra Madre Villa, Pasadena, Cal.

Print No. Ins. 123 on Reader Service Card

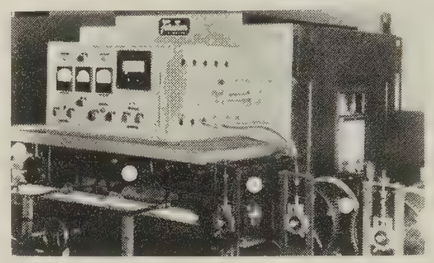
Yellow Neoprene Cable Offers Safety and Durability

The dual advantages of high visibility for safety and ruggedness for utility have been built into power cable with an outer cover of yellow neoprene. The new cable is expected to be particularly useful in plants and on many other indoor and outdoor projects where power equipment is used. The yellow cable has the same properties as black neoprene-jacketed wiring, including excellent weathering properties and resistance to abrasion and attack by ozone. Also, it is stated that the heat from an overload will not affect neoprene-jacketed wiring as it will other jacketing materials. The neoprene will stay in place when clamped and will not cold flow. The tradename "Broncolor" is molded into the wire at two-foot intervals, making it easy to measure quickly the desired amount of wiring. Other information including the type, size, number of conductors and voltage rating is also permanently molded on the outer cover of the cable. Broncolor cable is designed for 300 to 600 v and for loads up to 250 amps. It is available in two-, three-, or four-conductor sizes. Yellow is carried in stock in various sizes; production-run quantities of other colors, including control cables Types W and G, can also be purchased. Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58.

Print No. Ins. 124 on Reader Service Card

Postforming Machine Preheats Laminate Dielectrically

A special "high-frequency" machine preheats flat strips of laminated plastic dielectrically prior to post-forming. It is designed to roll form angles (or other shapes) 1″ x 1″ up to 4″ x 4″ in 10 ft lengths. A production rate of approximately 20 ft per minute reportedly may be obtained. Heating cycles obtained are in the order of 4 to 10 sec. Because only the sections that are to be formed need to be heated by the dielectric method, advantages are said to be cheaper tooling (initial, modification, or change), closer tolerances, less danger of precure at any high temperature, and higher maximum allowable working temperature because of the short heating cycle—hence smaller minimum radii. The illustration shows: 1) feed-in roller, 2) generator and controls, 3) electrodes, 4) feed-out roller, and 5) form rollers. Faratron, 4447 Union Pacific Ave., Los Angeles 23.



Print No. Ins. 125 on Reader Service Card

Tension Device for Banding Armatures with Tape

A new tensioning device for armature banding with epoxy-glass and polyester-glass banding tapes sells for $285. Dial indicates desired tension. The KTD-100 is said to properly apply any banding tape on the market. It mounts permanently on the back of a lathe. Data and instruction booklet available. Insulation and Wires Inc., P. O. Box 3349, St. Paul 1, Minn.

Print No. Ins. 126 on Reader Service Card

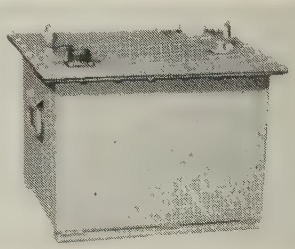
Machine for Pumping, Metering, and Applying Two-Part Compounds

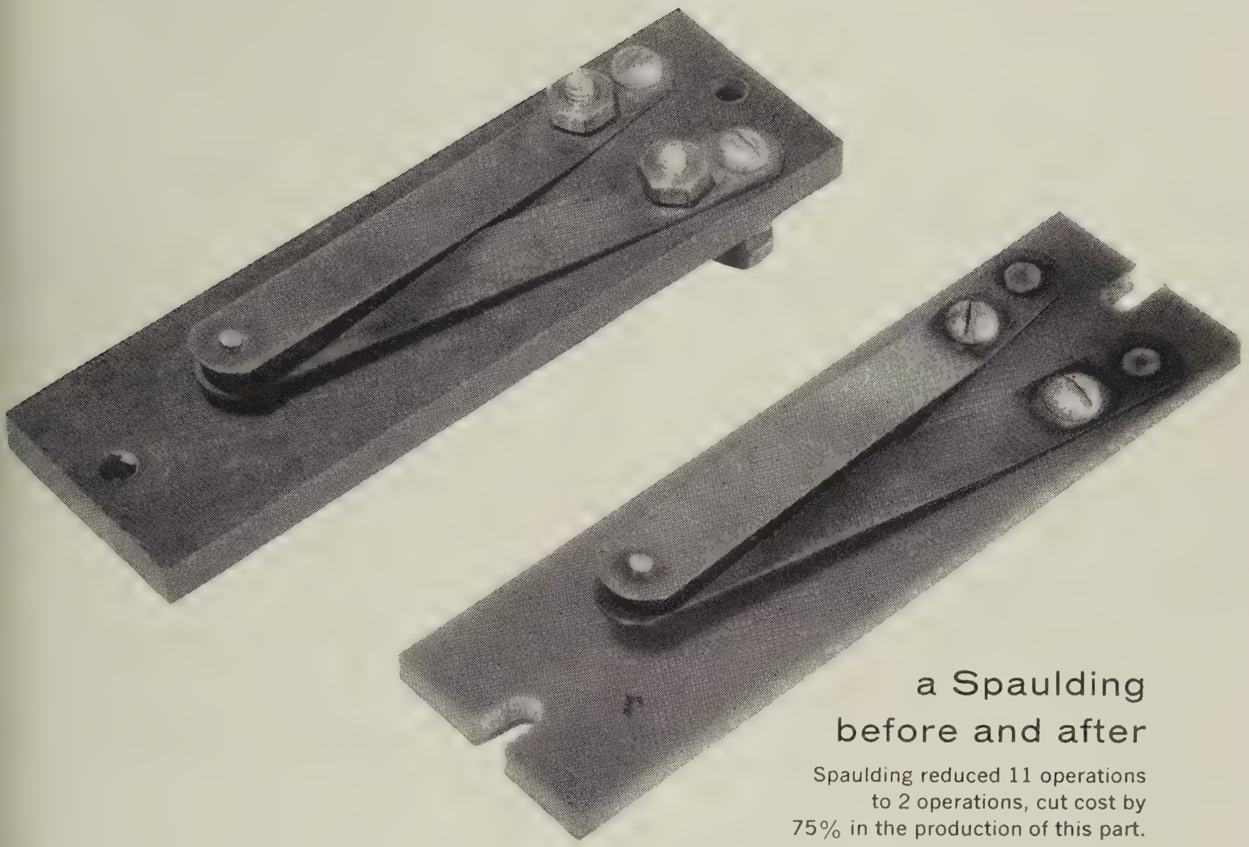
A new low-cost production machine is designed for continuous pumping, metering, and applying flowable two-part compounds. Uses include application of epoxy adhesives, insulation, sealing, coating, and foam materials. Called "Duo-Flo," the equipment can accurately meter a wide range of two-part compounds 0 to 20,000 CPS viscosity, 5 parts per hundred to 50-50 epoxies, polyurethanes, polyesters, and foam. The "Duo-Mix" gun reportedly sprays or flows thorough mixed materials yet can be purge and cleaned in minutes. Features o the new equipment include hig volume capacity, internal mix, adjustable spray range, and adaptabilit to 55 gallon drums. Pyles Industrie Inc., subsidiary of Kent-Moore Organization Inc., 20855 Telegraph Rd Detroit 41.

Print No. Ins. 127 on Reader Service Card

New 50 KV D-C Set for Dielectric Testing

Small size, light weight, and maximum ruggedness with low cost ar said to be features of model S50-5D high voltage test set. It produces 5 m continuously at 50 kv. The oil-fille high-voltage tank weighs 90 lbs, an measures less than 1 cu ft in volume It contains all HV components inclu ing metering facilities and an automatic output shorting switch—a gravity type solenoid—to insure automati discharge of capacitor on completio of test. Selenium rectifiers are use for ruggedness, long life, and enhanced reliability. A shielded polyethylene cable is used for HV outpu A fully instrumented control pane not shown, is mounted in a sloping front table top cabinet, or may b rack mounted. Designed for dielectri testing, and for leakage current measurements at high voltage, it can als be used as a high-voltage power sup





a Spaulding
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Spaulding reduced 11 operations
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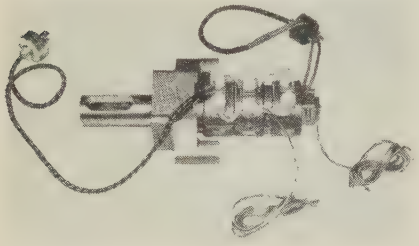
ply where up to 5 ma at 50 kv is required. It may be operated from any lighting circuit of 115 v a-c, 60 cycle, single phase. Peschel Electronics Inc., Towners, Patterson, N.Y.

Print No. Ins. 128 on Reader Service Card

Heating Cylinder for Injection Molders

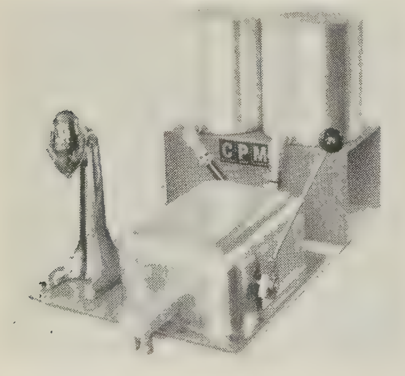
A new heating cylinder for "Mini-jector" plastic injection molding machines reportedly provides 50% to 100% greater heating capacity than available on previous cylinders. All existing Mini-jector models may be equipped with the new heating cylinder when a pyrometer is used. The new cylinder features a non-drool nozzle. Interchangeable plunger sleeves permit switching to bore sizes of 1-1/16″, ⅞″, ¾″, or ⅝″. Newbury Industries Inc., Newbury, Ohio.



Print No. Ins. 129 on Reader Service Card

Processing Equipment for Two Part Compounds

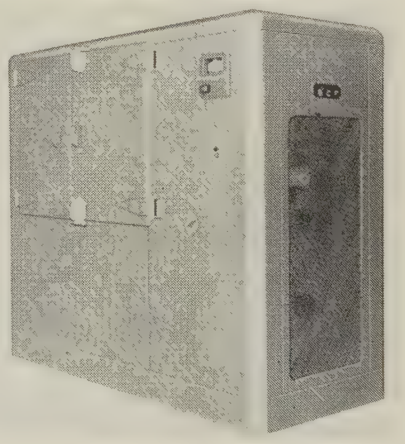
The "Multi-Rez-Processor" for proportioning, mixing, and dispensing multi-component reactive resins is stated to simplify the use of two part epoxy and polyurethane compounds. Proportional accuracy of the two component media dispensed is maintained through mechanical linkage operating positive displacement pumps. Thorough blending of the resin mix is accomplished by a motorized mixer. The "Teflon" impeller is the only part of the unit which enters the reactive resin mix. There are said to be no cleaning or purging problems as it is impossible for this equipment to freeze up. Short pot-life resin mixes reportedly can be handled with ease and safety. CPM Special Machinery Corp., 324 Butler St., Brooklyn 17, N.Y.



Print No. Ins. 130 on Reader Service Card

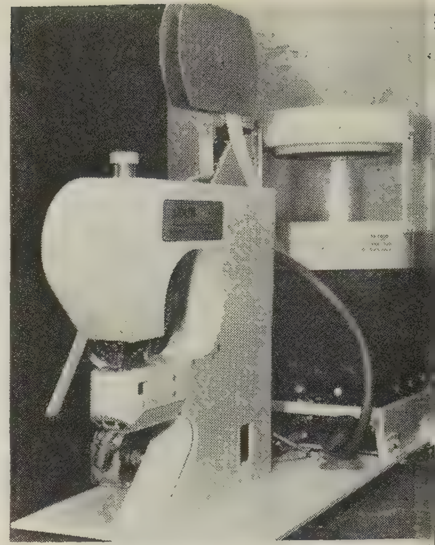
Lab Oven for 1000°F Uses

A new precision line of laboratory ovens with a heat range up to 1000°F (538°C) reportedly provides uniform automatic heat control ±½°F, and is adapted for use in "Teflon" fusing or sintering, glass annealing, and other processing where close temperature control is needed. Available for either gas or electric operation, the ovens are equipped with indicating-type automatic controls and provide uniform high velocity air flow through the work chamber. Six models, sized from 13″ x 13″ x 13″ to 48″ x 30″ x 12″. are standard. Smaller models are equipped with swing doors; larger units have counter-weighted vertical lift doors. Gas-fired models feature controlled combustion with atmospheric burners; electric units use vertically-mounted heating elements of open coil design supported by special ceramic insulators on alloy steel frames. An electronic safety system is provided with the oven. The "Top Temp," V-series ovens are shipped completely wired and ready to use. Bulletin 203-4A available. Despatch Oven Co., 619 SE Eighth St., Minneapolis, Minn.



Print No. Ins. 131 on Reader Service Card

Riveter for Contacts and Terminals In Printed Circuit Boards

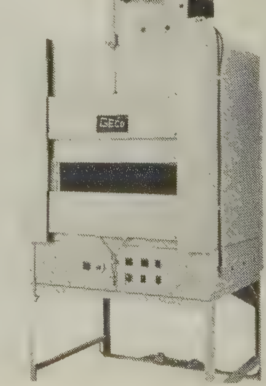


The Aidlin squeeze riveter is designed to rivet, swage, or form an insert into a fragile material so that stresses are not transferred to the fragile work. Originally designed to install contacts and terminals into printed circuits, the squeeze riveter can handle pins from 0.032″ to stainless steel rivets ¼″. Other applications include eyelet setting and swaged assemblies. Use of a pneumatic drive permits a gentle squeeze action to swage the rivet at a controlled rate instead of by impact Another feature is double plunger action. The upper plunger feeds a rivet and drives it into the work. The lower plunger moves upward, causing the rivet to swage or flare. This action reportedly permits riveting to the most delicate, brittle, and weak materials. Aidlin Automation Inc., 161 East New York Ave., Brooklyn 12 N.Y.

Print No. Ins. 132 on Reader Service Card

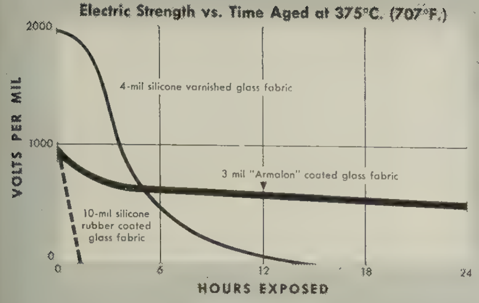
Plastic Sheet Preheating Oven

Floor space and oven heat are said to be conserved with the model PSC ovens designed to preheat plastic sheet prior to stamping. Air operated doors controlled by foot valves leave the operator's hands free for loading



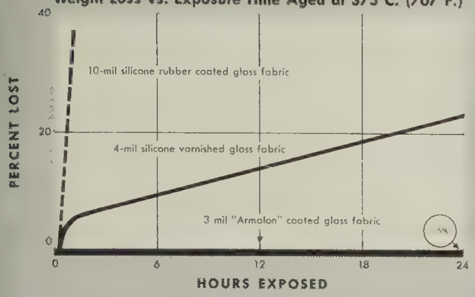
1. "ARMALON"

Electric Strength vs. Time Aged at 375°C. (707°F.)



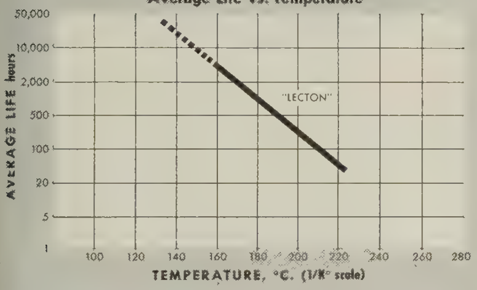
2. "ARMALON"

Weight Loss vs. Exposure Time Aged at 375°C. (707°F.)



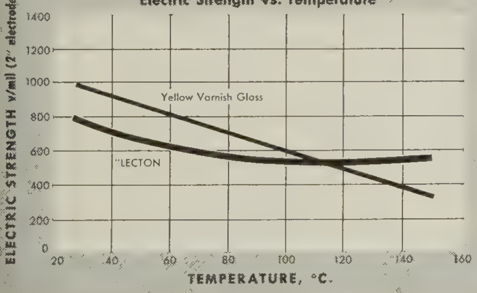
3. "LECTON"

Average Life vs. Temperature



4. "LECTON"

Electric Strength vs. Temperature



Thermal characteristics of 2 outstanding Du Pont coated fabric insulations

Armalon® for Class H service

For equipment that must operate at very high temperatures, "Armalon"* TFE-fluorocarbon resin coated glass fabrics have outstanding heat resistance. Insulation of "Armalon" can be used continuously at 482°F. and for short periods at even higher temperatures. Chart 1 compares high-temperature deterioration of electric strength for "Armalon", silicone varnished glass fabric and silicone rubber coated glass fabric at 707°F. Chart 2 compares weight loss for these insulations at 707°F. "Armalon" has much longer life at elevated temperatures and retains its flexibility and strength where ordinary materials become brittle. In addition, "Armalon" remains pliable at temperatures lower than -125°F. For full information about this outstanding Class H insulation, check the coupon below.

Lecton® for Class B service

"Lecton"* acrylic resin coated glass fabric is a superior insulation of moderate price that more than meets Class B requirements. It retains its properties in continuous operation at 270°F., and at 310°F. shows no appreciable loss in electric strength after 3,000 hours. Chart 3 shows the effect of temperature on the life of "Lecton", and Chart 4 compares the effect of temperature rise on dielectric strength for "Lecton" and yellow varnished glass fabric. "Lecton" has proved itself in Class B equipment because of its excellent thermal stability, and in hermetic refrigeration applications because of its superior resistance to fluorocarbon refrigerants and oils. For full information on this outstanding Class B insulation, check the coupon below.

FREE Illustrated booklets describe properties, test data and uses for Du Pont "Armalon" and "Lecton". Mail coupon or write Du Pont for your free copies . . . there's no obligation.

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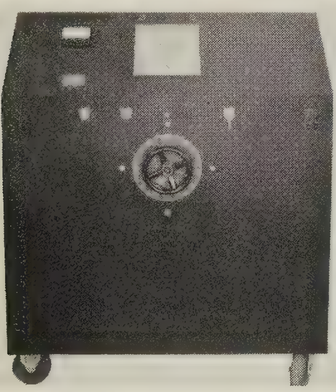
*Du Pont's registered trademarks.

and unloading. Models are available with doors on both sides to feed two operators. Oven shelves are lined with "Teflon" to prevent marking of sheet. All models are equipped with a motor driven blower and thermostatic control to 450°F. Gruenberg Electric Co. Inc., 9 Commercial Ave., Garden City, N.Y.

Print No. Ins. 133 on Reader Service Card

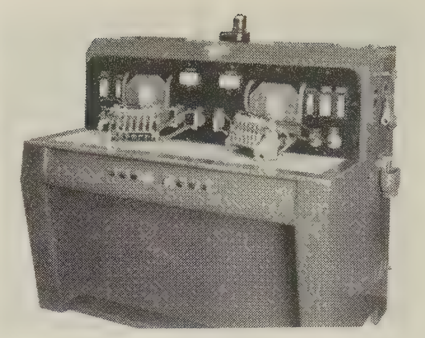
Variable, High-Voltage A-C Set For Dielectric Strength Testing

A variable high-voltage a-c test set for making dielectric strength measurements is designed to provide up to 40 kv. Model HV-50/40 kv can be used as a power supply for tests to be made in accordance with ASTM D-149 and Federal specification LP-406, Method 4031. Some specific tests are checking transformer oil, electrical tape, sheet laminates, and lineman's gloves, as well as "hi-potting" generators, motors, transformers, and other apparatus. This self-contained set includes controls, oil test jig, and metering. Output control has synchronous-motor drive to increase the output at a rate of 1000 vpm until breakdown occurs. Manual control is provided for other rates of voltage rise or constant-voltage operation. The built-in oil test jig has a removable cup with 1″ diameter electrodes spaced 0.1″ apart. Other jigs can be supplied as plug-in interchangeable units. A cable connection can be made for external testing. Many safety provisions are included. Multi-Amp Div., Multi-Amp Electronic Corp., 465 Lehigh Ave., P. O. Box 217, Union, N.J.



Print No. Ins. 134 on Reader Service Card

Only 80 Seconds to Weld and Seal Six Anode Terminals in Glass

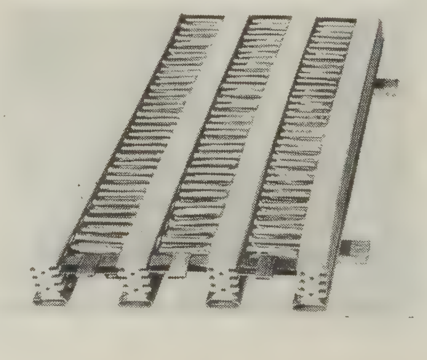


Six anode terminals reportedly can be welded and sealed in glass in 80 seconds utilizing a new two-place high frequency work station. Each place in the station permits attachment of a six-place coil and fixture. The anode is quickly located in juxtaposition to the glass by a fixture set in sapphire rods. The fixture is able to maintain a tolerance of .022 on a continuous basis, and the locaters are fully adjustable for optimum heating. Dept. PR-12, Induction Heating Corp., 181 Wythe Ave., Brooklyn, N.Y.

Print No. Ins. 135 on Reader Service Card

Packaged Porcelain Heating Racks For Temperatures to 1850°F

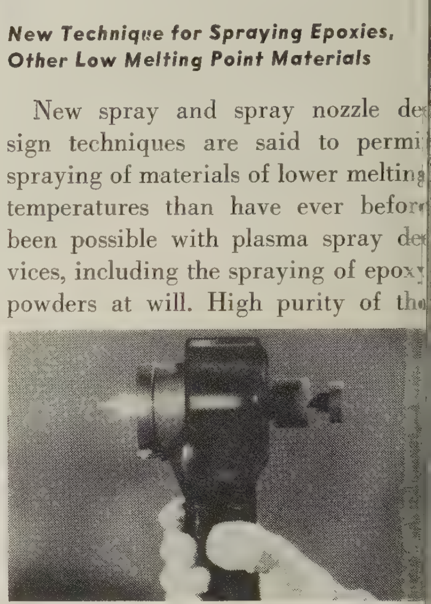
Heating racks 13 3/4″ wide by 22 1/2″ long are now available as a standard packaged heat source for frame temperature ranges to 1100°F (593°C), 1350°F (732°C), and 1850°F (1010°C). Primarily designed to serve as a source for natural and forced convection heating for various types of processing and manufacturing equipment, the racks may also be used as far and near infrared radiant heaters when properly selected and mounted. In general, the single-tier racks are manufactured for use in radiant heat ovens or furnaces, while the two and three-tier racks are for forced convection applications. The racks consist of a steel supporting frame, on which are mounted four rows of high-grade refractory porcelain which support one, two, or three tiers of 3-row-high "folded and formed" nickel-chrome, ribbon-type heating elements. In addition to convenient installation, benefits claime are more heat per unit, high workin temperatures, less maintenance, an simplified field repair, since there ar no screws or nuts to seize at hig temperatures. Trent Inc., 211 Leverington Ave., Philadelphia 27, Pa.



Print No. Ins. 136 on Reader Service Card

New Technique for Spraying Epoxies, Other Low Melting Point Materials

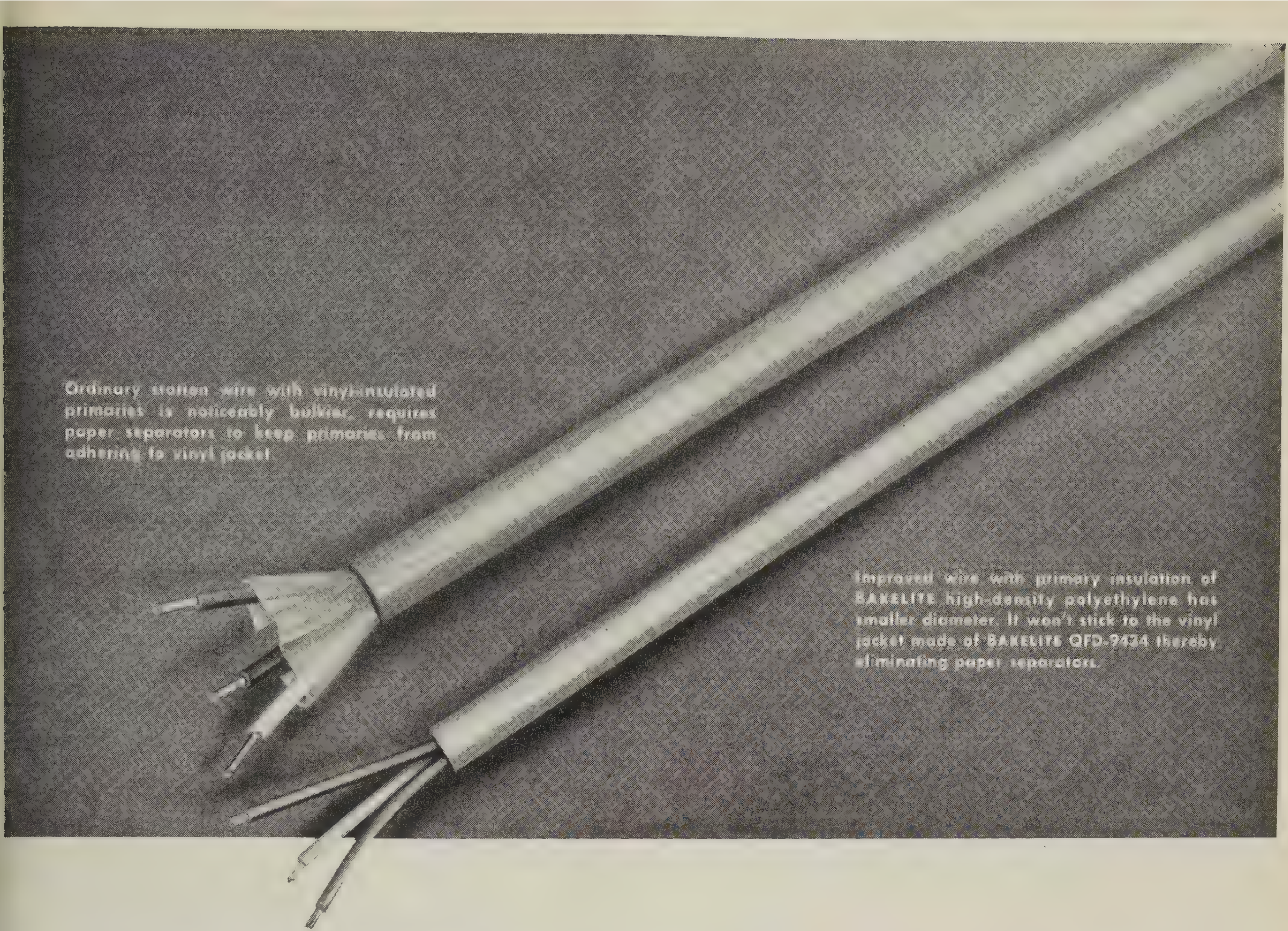
New spray and spray nozzle design techniques are said to permi spraying of materials of lower meltin temperatures than have ever befor been possible with plasma spray devices, including the spraying of epox powders at will. High purity of th sprayed materials reportedly is assured by operation of the spray equipment with inert gases. It is also expected that this technique will prov feasible for spraying organic compounds. The material melting rang of the new "Plasmatron" hand hel spray gun used for this technique ma be adjusted between 300°F and 30,000°F, permitting an extremely wid choice of materials for coating purposes. Plasmadyne Corp., 3839 S Main St., Santa Ana, Cal.



Print No. Ins. 137 on Reader Service Card

Automatic Wire Cutter

A new automatic wire cutter, mode CWA-300, is designed specifically fo production applications in the electronic and electro-mechanical assembly fields. Operating on 115v/60 cycle power, it reportedly can be set u and running in a matter of a few mi utes on any convenient bench or table. Wire lengths from 1″ to 60″ ca be produced, and a special attachment is available for jobs requirin lengths to 240″. All types of bare an insulated wire are said to be handle without marring or damage. Wir sizes from 26 gage to 12 gage can b accommodated with equal ease. A necessary adjustments for length an



Ordinary station wire with vinyl-insulated primaries is noticeably bulkier, requires paper separators to keep primaries from adhering to vinyl jacket.

Improved wire with primary insulation of BAKELITE high-density polyethylene has smaller diameter. It won't stick to the vinyl jacket made of BAKELITE QFD-9434 thereby eliminating paper separators.

LOOK AT HOW HIGH-DENSITY POLYETHYLENE REDUCED THE SIZE OF STATION WIRE!

...thinner walls bring new benefits

When Alphaduct Wire and Cable Corporation switched to insulating station wire primaries with BAKELITE high-density polyethylene DGD-4100, smaller, neater looking constructions were made possible . . . at lower costs.

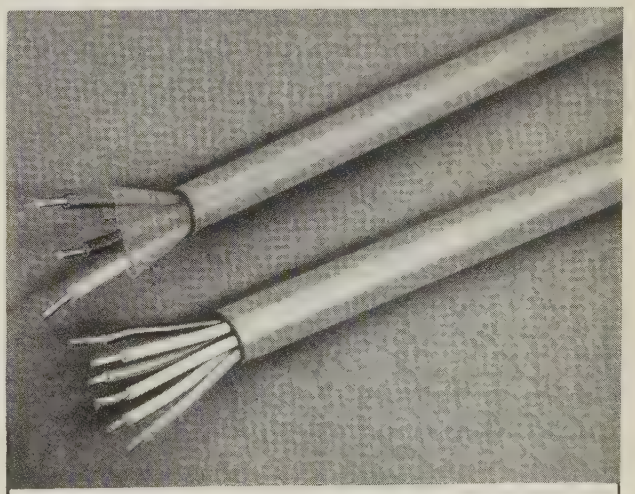
Thinner walls of insulation provided by the exceptional toughness of BAKELITE high-density polyethylene have brought impressive benefits to fabricator and user:

Station wire is now less bulky, has lighter weight and smaller diameter; exposed installations won't look untidy.

Paired station wire, available for the first time in two, three and four pairs, can be made the size of previous station wire.

The toughness of BAKELITE high-density polyethylene even makes stripping of the jacket easier—any of the insulated primaries can be used to rip cleanly through the vinyl jacket.

By insulating primaries with BAKELITE high-density polyethylene, you can expect superior electrical and physical properties leading to maximum service life, smaller space requirements and substantial savings in material costs. For more information on how this material can improve your product, write Dept. DZ-75, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Toronto 12.



New three-pair station wire is slightly larger than old construction with fewer primaries ...thanks to thinner wall insulation.

UNION CARBIDE

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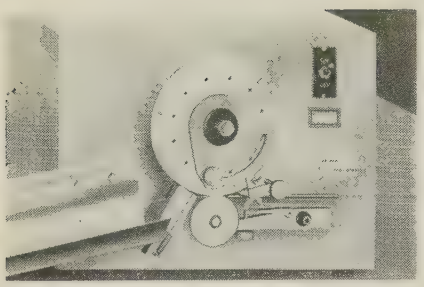
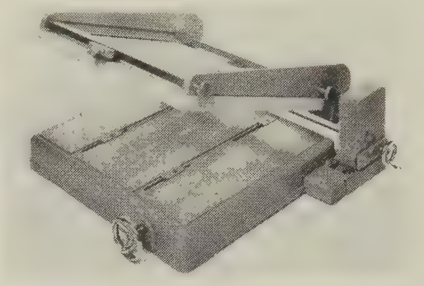


wire size are accomplished on the front panel and can be made in three to five minutes. An automatic throwout permits single piece operation for prototype or set-up purposes. Typical production rates reported are 3600 pieces per hour for a 20″ length and 900 pieces per hour for a 60″ length. A reset counter is provided and a preset counter switch is available as optional equipment. Descriptive literature available. Dickinson & Associates, 940 Alma St., Glendale 2, Cal.

Print No. Ins. 138 on Reader Service Card

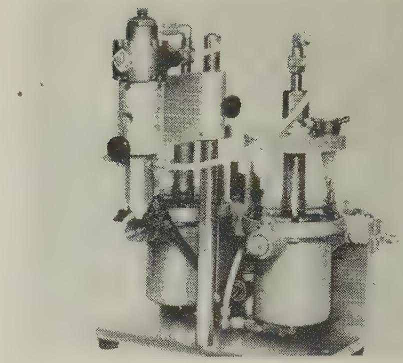
Circuit Board Screen Printing Unit

A new hand-operated screen printing unit for prototype and short production runs of circuit boards and other devices provides a 12″ × 18″ printing area with 17″ × 20″ inside and 20½″ × 23½″ outside screen dimensions. The unit has a quick-acting screen clamp. A floating bar frame is available on special order. Front-to-back adjustment is a maximum of 2½″. Maximum lateral adjustment is 2″, and maximum vertical adjustment is 2½″. Individual adjustment permits swinging the screen through an angle of 20°. The base can be furnished either plain or milled for jig clamps. Savings in set-up time and faster and more accurate registration are claimed. Charles F. Forslund, 3510 Rubin Dr., Oakland 2, Cal.



Print No. Ins. 139 on Reader Service Card

Automatic Dispenser for Epoxies, Other Resins, Eliminates Wastes

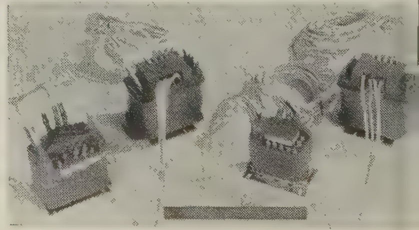


The model 100 "Nuplabond" machine is a small, self-contained, hig speed machine for metering, mixing and dispensing two-component plastic systems such as epoxies. The machine automatically pumps a controlled amount of each componen from its reservoirs to the mixin chamber, cycles itself through a controlled motor driven shear and agit tion mixing operation, and dispense the measured and mixed charge wit a positive drip-proof cutoff. It reportedly assures uniform volum hardening, and strength of dispense two-component systems, and elim nates the waste encountered in han mixing. The machine is stated to b easily adjusted to a wide range o cycles and materials, simple to ope ate, easy to clean, and is designe to be used manually or adapted t any automatic or semiautomatic production line. New Plastic Corp., 102 N. Sycamore Ave., Los Angeles 38

Print No. Ins. 140 on Reader Service Card

Silicone Impregnated, Encapsulated Transformers

At Laboratory for Electronics Inc Boston, engineers have selected room temperature vulcanizing silicon rubber compound to encapsulate an impregnate high voltage transforme for air-borne navigational system The silicone rubber compounds supplied by General Electric Co. repor edly provide a deep coil penetratio high temperature resistance, goo heat transfer, and a tough resilie external covering.



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High quality board combining electrical purity with exceptional strength. For use in transformers, motors and capacitors. Available in thicknesses from .005″ to .020″.

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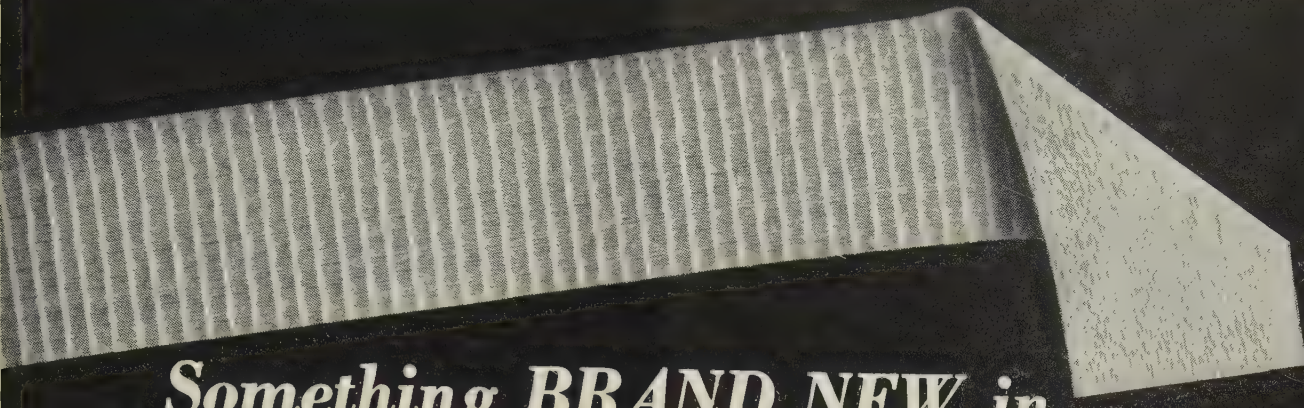
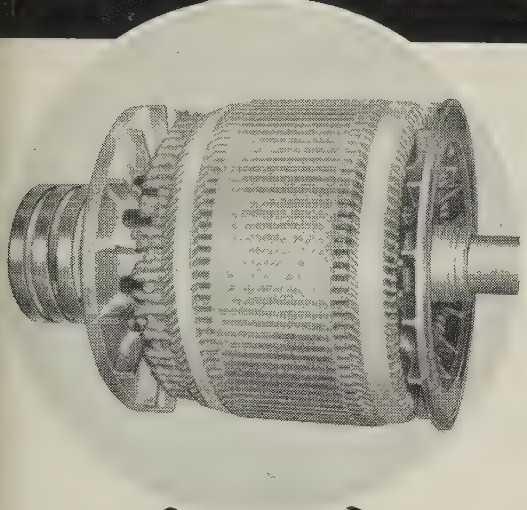


Something BRAND NEW in . . . Fiberglass Armature Banding Tape!

VEC-O-TEX



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DEC. 5, 6, 7, 8, 1960

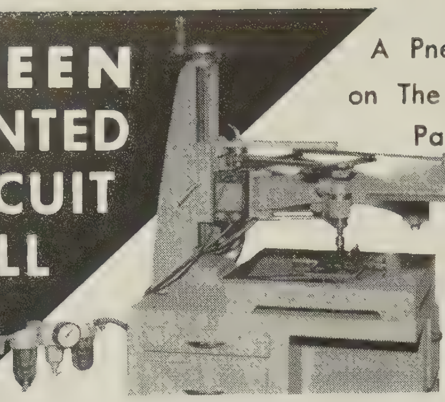
FOR INFORMATION write to Mr. Hollis Bascom,
Coast Mfg. and Supply Company, P. O. Box 71
Livermore, California, Phone HI 7-1000

TREVARNO
VEC-O-TEX

A Product of Coast Manufacturing and Supply Company • Livermore, California
A Leader in Industrial Glass Fabrics and Finishes since 1947 • Established 1867
Plants are located in Livermore, California, and Seguin, Texas

Print Ins. 46 on Reader Service Card

GREEN PRINTED CIRCUIT DRILL



A Pneumatic Attachment on The Green Model D2 Pantograph Engraver rapidly drills holes in printed circuits by tracing templates.

- **Drill as many as 100 holes per minute, Foot switch actuates air powered operation.**
- **Drill speeds and feeds have independent adjustments. Feed regulated by air pressure.**
- **Spindle speeds up to 26,000 rpm. Permits use of carbide drills when required.**
- **D2-201 air attachment includes spindle air cylinder, regulating valve and pressure gauge, foot switch, filter and oiler, ready to operate when connected to compressor.**

The Model D2 Heavy Duty Pantograph Engraver features ratios of 2 to 1 to infinity. Unobstructed on three sides to handle large work. Micrometer adjustment for depth of cut. Vertical range 10″ adjusting copy table automatically with pantograph.

FOR FULL DETAILS, WRITE, WIRE OR CALL

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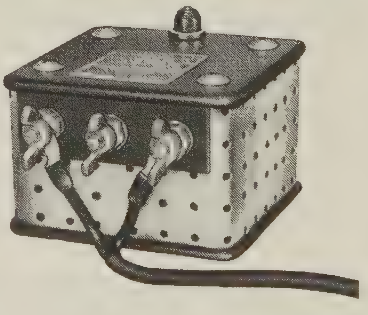
SOLVE WIRE-STRIPPING PROBLEMS

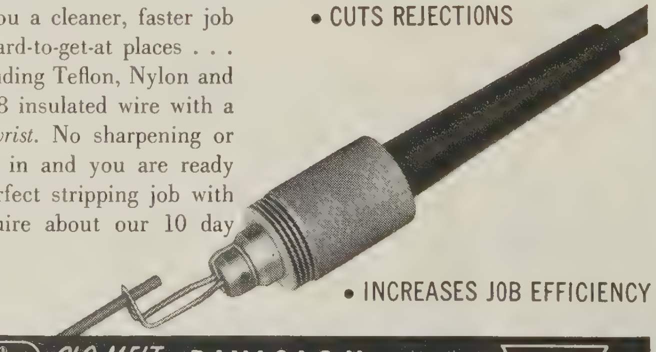
with NEW Wassco® GLO-MELT WIRE STRIPPER

FAST, FLEXIBLE AND ECONOMICAL REMOVAL OF ALL PLASTIC INSULATED WIRE

Wire stripping problems fade away with a Wassco Glo-Melt wire stripper. This new tool is a cool, light, highly flexible hand piece with a single, heavy duty Nichrome cutting element for long life. It can be used for on the job applications or for bench work with optional foot control. The Wassco Glo-Melt wire stripper gives you a cleaner, faster job . . . is perfect for hard-to-get-at places . . . strips insulation including Teflon, Nylon and fiberglass up to No. 8 insulated wire with a simple *twist of the wrist.* No sharpening or adjusting,—just plug in and you are ready instantly to do a perfect stripping job with speed and ease. Inquire about our 10 day free trial.



• CUTS REJECTIONS



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206-B

Wassco GLO-MELT DIVISION
AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICHIGAN

American Beauty Electric Irons Since 1894

Print Ins. 48 on Reader Service Card

Nylon Jackets Airport Wire

A system of domed pancake lights recessed in the center of the runways and taxiways at the Federal Aviation Agency's National Aviation Facilities Experimental Center at Atlantic City includes 1,100 pancake lights connected by more than 13 miles of wire jacketed with DuPont's "Zytel" 37X nylon resin. The installation involved cutting of the wire channel with a diamond-bladed concrete saw. The nylon jacketed wire had to be able to withstand the abrasion encountered in the pushing and pulling down through 1-inch deep, ¼-inch wide sawcuts in the concrete runway. After the cable was pushed down into the saw cut, a permanent sealant was applied to complete the job. The cable consists of a seven-stranded conductor with a thin-wall, high-performance polyvinyl chloride insulation, jacketed with .006 inch of nylon resin.

Conductive Flooring

Conductive flooring is as serviceable as nonconductive flooring of the same type and it reduces explosion hazards according to a recent National Bureau of Standards investigation. Although the flooring was investigated primarily for use in hospital operating rooms, many of the results should apply equally well to floors used in other locations such as munition plants. Within some limitations, architects may now choose conductive flooring materials on the basis of the behavior of similar nonconductive materials. If static electricity is allowed to accumulate in hospital operating rooms, it can cause sparks having sufficient energy to ignite explosive vapors. The most effective means for reducing this hazard is to keep the electrical resistance between objects in the area so low that the minimum sparking voltage is never attained. Conductive flooring provides the necessary linkage because most objects normally rest on the floor. Electrical resistance of flooring materials is generally lowered by adding carbon black to the material.

Tiny Wafers for Microelectronics

Tiny wafers shaped by a photographic process are being used by CBS Electronics in its microelectronics program.

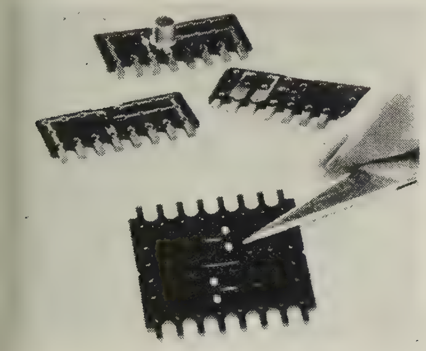
Substrate for the firm's Universal Micro-decks is a photosensitive glass-turned-ceramic ("Fotoceram") produced by Corning Glass Works.

Pattern of the wafers is implanted in the photosensitive glass, then the image is etched away by acid to the precise shape and dimensions required.

Heat treatment converts the special glass into a rugged ceramic material that takes metallizing extremely well.

Wafer design can be changed swiftly and easily merely by changing the photographic negative used to implant the pattern in the glass.

One wafer measures only 1.25 x 0.6 x 0.055 inch. This space contains 8 protruding contact bars, 3 slots, and 19 tiny holes. Part of one edge of the wafer as well as the bars are metallized for electrical contact to a standard interconnection panel. Completed Micro-decks carry metallized circuit runs on each face of the wafer, plus components such as resistors, transistors, and diodes.



Initial uses have been in computers and in equipment for aircraft and missiles. The Micro-decks are also suitable for analog circuitry.

WATCH

Haadknose Byer being sold on the astounding new dielectric material, ISOESTERENE, at the Insulation Conference Marketing meeting in Chicago, Dec. 8.

Tetroc
Ceroc
CERAMIC INSULATION
THIN SILICONE FILM
SINGLE TEFLON OVERLAY
DOUBLE TEFLON OVERLAY
CERAMIC SINGLE-SILICONE
CERAMIC SINGLE-TEFLON
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THESE ARE SPRAGUE'S TWO OUTSTANDING

HIGH-TEMPERATURE MAGNET WIRES

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 200°C

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO 250°C

ENLARGED CROSS-SECTIONS OF CEROC® COPPER MAGNET WIRE

Sprague offers you a choice of 2 *truly* high temperature magnet wires: For continuous operation at hottest spot temperatures up to 200°C (392°F) and up to 250°C (482°F) for short periods of time—depend upon TETROC—an all Teflon-insulated wire available in both single and heavy coatings.

CEROC is Sprague's recommendation for continuous operation at hottest spot temperatures up to 250°C (482°F) and up to 300°C (572°F) for short periods of time. Ceroc has a flexible ceramic base insulation with either single silicone or single or heavy Teflon overlays. The ceramic base stops "cut-through" sometimes found in windings of all-fluorocarbon wire. Both Tetroc and Ceroc magnet wires provide extremely high space factors. ★ ★ ★ ★ ★

FOR COMPLETE DATA WRITE FOR ENGINEERING BULLETIN 405 (TETROC WIRES) 400A (CEROC WIRES).

SPRAGUE ELECTRIC COMPANY
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New Publications

Books

Progress in Non-Destructive Testing, edited by E. G. Stanford and J. H. Fearon. The second of an annual series of international volumes containing critical reviews of special aspects of the general subject, this volume contains reports on: Radiology with High-Energy X Rays, Mechanical Testing of High Polymers, Application of Electrical Methods for the Detection of Flaws and for the Study of Metal Structure, Uses of Radioactive Isotopes in Non-Destructive Testing, Defect Assessment Using Ultrasonic Waves, Studies of Aging and Precipitation in Metals Using Anelastic Damping Measurements, and Application of Paramagnetic Resonance to Non-Destructive Testing. 250 pages, $12. The Macmillan Co., 60 Fifth Ave., New York 11.

Proceedings of the Fifth Conference on Magnetism and Magnetic Materials. It includes technical papers reflecting work being done on magnetism and magnetic materials in physics, chemistry, metallurgy, crystallography, and other areas. Among the subjects covered are garnets, permanent magnets, magnetic modes, computers-switching, magnetic films, anisotropy, techniques and devices, resonance, soft magnetic materials, metals and alloys, magnetic salts, magnetic compounds and neutron diffraction, ferrimagnetic resonance, and magnetism in medicine. 410 pages, 7⅞" x 10½", 340 illustrations, $10. McGraw-Hill Book Co., 330 W. 42nd St., New York 36.

Technical Illustration by Anthony D. Pyeatt. A one-volume series of lessons with lesson plans in the back. Much of the material is concerned with the manuals which industry finds increasingly necessary to assemble, service, and repair complex mechanisms. Paperbound, 125 pages, $ Higgins Ink Co. Inc., 271 Ninth St Brooklyn 15, N.Y.

NYTL Laboratory Guide Report Monthly reports on problems encou tered in laboratory procedures in a fields of industrial laboratory wo will cover not only conventional ap proaches, but the latest in laborato techniques as well. Each month su scribers will receive at least fou Guide Reports drawn from more tha 300,000 test programs. Under $20 pe year. New York Testing Laboratorie 47 West St., New York 6.

NEMA Standards

HU 1-1960 (June), Industri Heating Units and Devices. Revise to include latest information on d electric strength. Covers cartridg tubular, strip, immersion, and tub lar-type water immersion heaters. 3 cents.

HV 1-1960, Summary of Chara teristics of Apparatus Insulators. R vised to give the latest cantileve strength values for cap- and pin-ty mixed apparatus insulators. 25 cent

SK 50-1960, EIA-NEMA Stan ards for Color Coding Semiconduct Devices (Diodes and Rectifiers). 2 cents.

Other Literature

List of Commercial Standards. R vised to July 1, 1960, the new inde lists all Commercial Standards unde 22 classifications including electric and mechanical equipment, paper an petroleum products, plastics, and ru ber products. Also available is a pam phlet entitled, *Commodity Standard What they are—How they are done-*

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Light Weight Prefoamed Low Cost
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Why they are used. Single copies of Catalog No. 978 and Commodity Standards Pamphlet available without charge from the Commodity Standards Div., U.S. Dept. of Commerce, Washington 25, D.C.

Bibliography on Molecular and Crystal Structure Models, by Deane K. Smith. National Bureau of Standards Monograph 14, issued May 20, 1960, presents a bibliography on molecular and crystal structure models used extensively in research and as teaching aids. 7 pages, 15 cents. Order from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

RS-232, Interconnection of Data Terminal Equipment with a Communications Channel (new material from S. P. No. 625). May 1960, 7 pages, 50 cents. Order from the Electronic Industries Association, Engineering Office, Room 2260, 11 West 42nd St., New York 36.

American Standard C42.45-1959, Definitions of Electrical Terms, Electromechanical Devices. $1. Order from the American Institute of Electrical Engineers, 51 East 42nd St., New York 17.

Electronic Specifying and Purchasing. Lists nearly 10,000 firms engaged in the manufacture, sale, and distribution of electronic components and equipment. The comprehensive source guide has over 60,000 separate listings. Electronic Periodicals Inc., 2775 S. Moreland Blvd., Cleveland 20, Ohio.

SPE Transactions. A new quarterly scientific journal which begins in January 1961, it will contain articles on basic polymer theory, science, and engineering. It is available to all on a subscription basis and will contain no advertising. Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.

American Standard Y14.15-1960. Electrical Diagrams. Contains definitions and general information applicable to most of the commonly used electrical diagrams, including detailed recommendations on preferred practices for use in the preparation of these diagrams. $1.50. American Standards Association, 10 East 40th St., New York 16.

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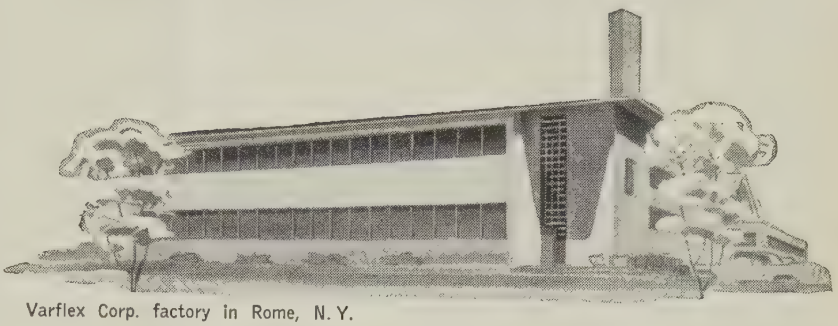
SLEEVING and TUBING
used by leading American manufacturers



Varflex Corp. factory in Rome, N.Y.

Pick any combination of characteristics, and there is a Varflex sleeving or tubing to meet them. In the toughest applications of all — in jet plane components which *must* operate efficiently at temperatures ranging from —85° to 500°F. — Varflex has proved its reliability again and again.

Any or all of the following characteristics are available in the degree that fits your application: high dielectric retention . . . high thermal stability . . . high tensile, mechanical or impact strength . . . non-interference with magnetic field . . . excellent resistance to oil, grease, alkali, acid, heat, pressure, vibration.

Choose from the World's MOST COMPLETE LINE

Varglas Silicone Rubber Tubing. Class H-A-1. The ultimate in flexibility, yet dielectric protection to 8000 volts. Class H-B-1 (4000 volts) available, also. Continuous exposure from minus 70°F. to 400°F. does not affect coating or braid.

Varglas Silicone Rubber Sleeving. Made in Class H-C-1 (2500 volts) and Class H-C-2 (1500 volts).

Varglas Silicone Resin Tubing. Class H-A-1 is recommended for applications requiring extremes of heat endurance and high dielectric strength (7000 volts). Class H-B-1 is identical except for dielectric guarantee (4000 volts). Good abrasion resistance.

Varglas Silicone Resin Sleeving. Made in Classes H-C-1 (2500 volts), H-C-2 (1500 volts) and H-C-3.

Silflex Sleeving. A light coating of Silicone resin on fiberglas braid. Extremely flexible within a temperature range from minus 85°F. to 500°F.

Varglas Silicone Lead Wire. Made from solid or stranded wire covered with one or more walls of Fiberglas braid and impregnated with Silicone resin.

Varglas Silicone Tying Cords. Continuous filament Fiberglas cords impregnated with Silicone resin. 1/64″ to 1/8″ diameter. Specify dry cure or tacky cure.

Varfil Tubing and Sleeving. Fiberglas braids impregnated with polyester resin. Four grades available in coils as well as 36″ lengths in most sizes. In a class by itself because of its toughness, flexibility, high temperature resistance and ability to withstand bending and twisting without dielectric loss. Compatible with varnish.

Varflo Tubing and Sleeving. Class B insulation. For those who need flexibility, solvent, oil and moisture resistance, and yet do not require Class H insulation. Will pass the NEMA heat endurance test of 15 minutes at 425°F. Also passes 300 hours at 300°F. Varflo has good shelf life and will not lose dielectric strength when subjected to severe twisting.

Varglas Varnished Tubing. Flexible continuous coatings of flame resistant varnish built up over Fiberglas braid in eight or more carefully controlled operations.

Varglas Varnished Sleeving. NEMA Classes B-C-1, B-C-2, and B-C-3 are similar except for dielectric strength.

Varglas Non-Fray Sleeving—Type H. The normalizing treatment given the Fiberglas braid removes the organic impurities and tends to hold the individual filaments together. May be subjected to temperatures as high as 1200°F. Recommended for applications where dielectric requirements are not of prime importance. Resists fungus and is non-corrosive.

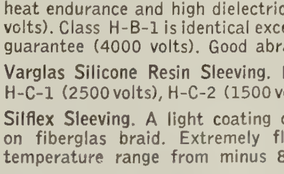
Varglas Non-Fray Sleeving—Type HO. Has a very light treatment of resin after the braid has been normalized—just enough to hold the sleeving round for accurate cutting. Will distend to cover soldered joints or terminals. Available in eight colors, sleeving unaffected up to 1200°F.

Varglas Litewall Sleeving. Wall thicknesses of .008″ and .006″ available untreated or treated.

Syntholvar Extruded Tubing. Several formulations of vinyl polymers. All have high dielectric and tensile strength. Will not support combustion nor absorb moisture. Smooth surface, thin wall and flexibility all make for ease in assembling operations. For installations where temperatures of 105°C. must be withstood. Also will function at temperatures down to —65°C. Specify fungus resistant tubing where needed.

Varflex Cotton Tubing. Furnished with lacquer or varnish as the impregnant. Braided from long staple cotton yarns. Four standard NEMA grades.

Varflex Cotton Sleeving. Available in three NEMA grades, Classes A-C-1, A-C-2, and A-C-3.



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Makers of Electrical Insulating Tubing and Sleeving

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card — no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Facts on Fluorosilicone Rubber

New brochure No. 9-113 contains facts on "Silastic" LS fluorosilicone rubber. Material is described as possessing solvent resistance over a wide temperature range, combined with many of the basic properties of silicone rubbers. Graphs show the performance of Silastic LS during oven agings and ASTM oil exposure tests. Typical properties and practical tables suggest when to design with material for applications requiring solvent, fuel, oil and fluid, and chemical resistance. Dow Corning Corp., Midland, Mich.

Print No. Ins. 201 on Reader Service Card

Bulletins on Silicone Rubber Insulations

New bulletin 205-A describes the use of unsupported silicone rubber tapes in the insulation of large motor and generator coils and other insulating applications. Advantages are listed, several types are described, and a detailed chart of minimum properties is included. In addition, the application of two complete systems is covered completely. 4 pages. Bulletin 312 provides technical specifications for a self-adhering triangular tape. 3 pages. Moxness Products Inc., 1914 Indiana St., Racine, Wisc.

Print No. Ins. 202 on Reader Service Card

Data on Varnish for Use With Magnet Wire

A new technical bulletin, "Varnish for Use with Poly-Thermaleze and Similar Magnet Wires," presents data showing the results obtained with "Isonel" 31 varnish. Included in bulletin S-123 is a graph on thermal life (AIEE No. 57 Procedure), indicating class F, B, or A capability. Suitability for rotors as well as stators is suggested by the results of helical-coil bonding-strength tests, also summarized in graph form. 4 pages. Schenectady Varnish Co. Inc., Schenectady 1, N.Y.

Print No. Ins. 203 on Reader Service Card

Brochures on Irradiated Polyolefin Sleeving That Shrinks to Fit

Two brochures cover the properties and applications of "Thermofit," an irradiated modified polyolefin insulation sleeving which shrinks to a preselected diameter when exposed to heat. RNF #203-4 lists all properties, test data, weights, sizes, and various applications. 8 pages. RT-2000 describes use in harnessing and gives some valuable information on harnessing techniques. 12 pages. Raychem Corp., Oakside at Northside, Redwood City, Cal.

Print No. Ins. 204 on Reader Service Card

Data Book on RTV Silicone Rubbers

New publication contains product and application data on a complete family of RTV (room temperature vulcanizing) silicone rubber compounds for potting, encapsulating, and sealing applications. Technical Data Book S-3 also contains information on silicone rubber sponge and on RTV-11, a new low viscosity liquid silicone rubber compound. It also includes additional information on thermal conductivity compression set of RTV's along with an expanded section providing new data on heat aging and electrical properties. A new section in the bulletin deals with molding RTV in RTV. Featured are suggestions for handling RTV compounds, curing and viscosity characteristics, and information on RTV primers for bonding applications. 12 pages. Silicone Products Dept., General Electric Co., Waterford, N.Y.

Print No. Ins. 205 on Reader Service Card

Bulletin Describes Method of Spray Coating with Ceramic Insulation

A new bulletin titled "Mounting Sensing Elements" describes methods
of mounting temperature and str
measuring elements by means
"Rokide" ceramic spray coatings. T
technique, which can be used to ap
insulating coatings, is covered in
tail in bulletin H-3.1. 8 pages. Ad
tising Dept., Norton Co., Worces
6, Mass.

Print No. Ins. 206 on Reader Service Card

Brochure on Silicone Rubber Wire, Tape, and Tubing with Sample

New brochure describes extru
silicone rubber products: tubing,
angular guide line tape, and insula
lead wire. Electrical and therr
characteristics; physical properti
flexibility; low temperature, che
cal, fungi, and radiation resistan
compatibility; permanence; and
ter absorption data are given. Ty
sizes, colors, and other specificati
are also included. 4 pages. L. Fr
Markel & Sons, Norristown, Pa.

Print No. Ins. 207 on Reader Service Card

Cable Marking System Catalog

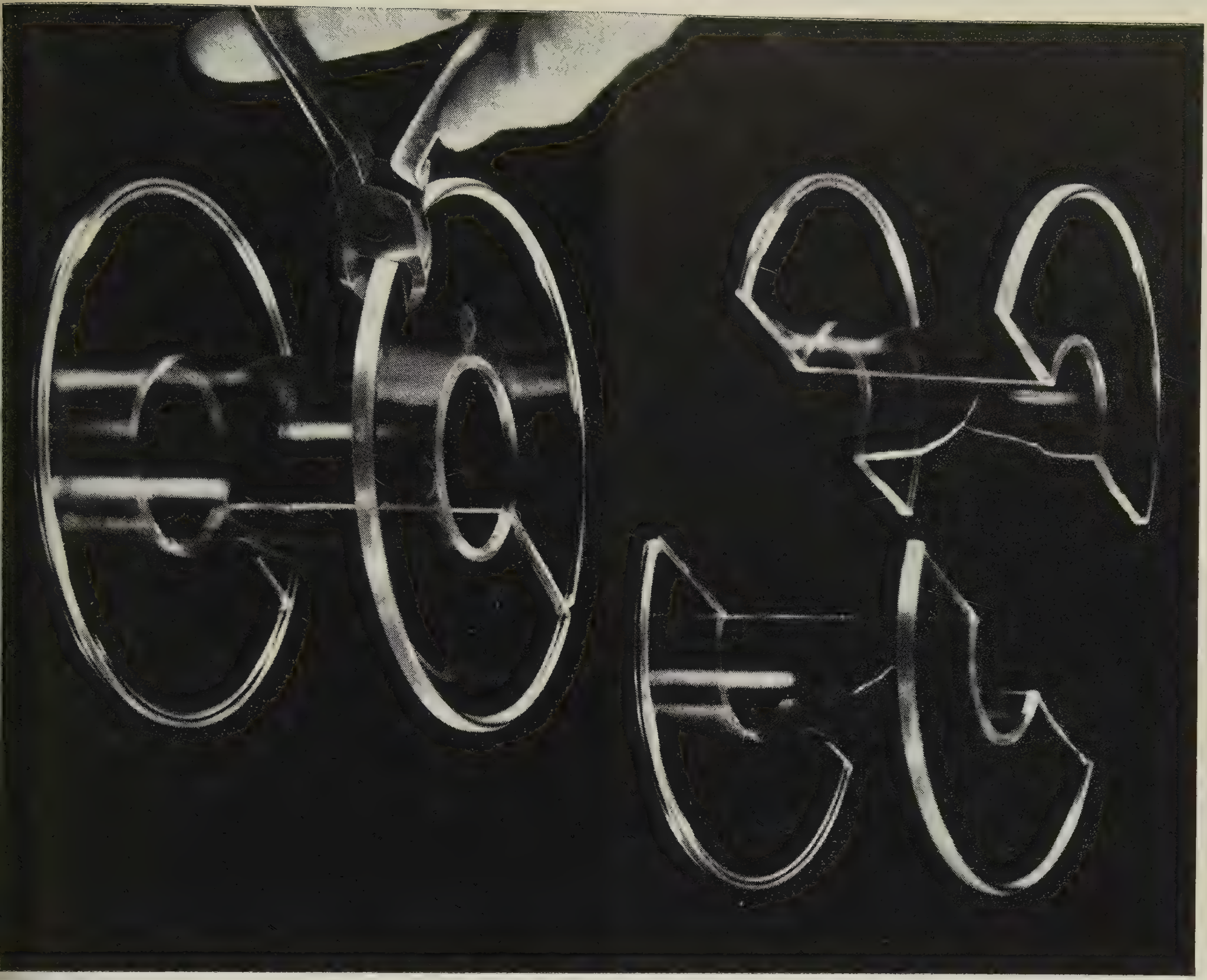
Catalog describing a wire and ca
marker system has extensive "in-u
illustrations that show how the ma
ers offer installers operational fle
bility, lifetime serviceability,
improved application speed—all a
lower total cost. A list of specif
tions and traceable drawings are
sented on an easily detachable f
out page for drafting departme
use. An explanation of the packag
arrangement is also presented.
pages. Electrovert Inc., 124 East 4
St., New York 16.

Print No. Ins. 208 on Reader Service Card

Bulletin Describes Triangular Silicone Insulating Tape

A new technical bulletin fully
scribes self-adhering CDF "Le
Wrap" triangular silicone rubber
sulating tape. Designated CDF Te
nical Bulletin 18,110, it presents f
tables that list grades and sizes, to
ances, standard rolls, and typ
properties. 2 pages. Continental-
mond Fibre Corp., a subsidiary
The Budd Co., Newark, Del.

Print No. Ins. 209 on Reader Service Card



Reduce magnet wire production costs

COMBINATION OF NEW J-M PLASTIC SERVING PACKAGE AND IMPROVED, LOW-TWIST FIBER GLASS YARN OFFERS MORE ECONOMICAL PRODUCTION OF QUALITY WIRE.

This new one-piece molded plastic serving package is designed to help you get additional production of better quality magnet wire—at lower cost! Here's how this new J-M package increases efficiency and economy.

SPEEDS PRODUCTION Each flange of this one-piece, clear plastic spool is molded with a partial split. When the yarn runs out, snip the flange opposite the split with ordinary wire-cutters – and the whole package breaks neatly in half, permitting quick removal from the spindle. No sharp edges, shattering or splintering. And because these new J-M packages are larger, fewer changes on the machine are required.

IMPROVES QUALITY Now you can use yarn packages with increased way wind . . . get smoother delivery of yarn to the wire with minimum abrasion, fuzzing and skips. Flanges are always in position, protecting the yarn—yet the transparent plastic lets the operator see how much yarn remains on the package at all times.

REDUCES COST Use low-cost glass yarns at no sacrifice in quality! These new serving packages permit the use of low-twist yarns with an improved starch-free binder that protects the yarn from abrasion. Low-twist yarns also assure the same finished wire diameters as the more expensive plied yarns.

Johns-Manville all-plastic serving packages are available in two inside diameters: 1⅛" and 1⅝". For complete information on this new development in magnet wire production, write to Johns-Manville, Box 14, New York 16, N. Y.

JOHNS-MANVILLE
FIBER GLASS

JOHNS MANVILLE JM PRODUCTS

Print Ins. 52 on Reader Service Card

Manual on Silicone Rubber Insulation for Wire and Cable

Reliability, versatility and long life are the outstanding characteristics of wire and cable insulated with "Silastic" brand silicone rubber according to a new descriptive manual. With data charts and graphs, the brochure explains why Silastic insulated wire and cable has great load carrying capacity. Ability to withstand long-time exposure to severe environmental and operating conditions including heat, cold, moisture, weathering, corrosive fumes, ozone, corona, and nuclear radiation is also discussed. A variety of dielectric applications are pictured. 6 pages. Dow Corning Corp., Midland, Mich.

Print No. Ins. 210 on Reader Service Card

Data Sheet on Fluorine-Containing, Heat Resistant, Thermoplastic Resin

Data sheet VF2R-61 lists properties of new resin RC-2525, a crystalline, high molecular weight polymer of vinylidene fluoride which is still in developmental status. Methods of fabricating into sheets, rods, tubes, and intricate shapes and of forming thin protective coatings over substrates are given. 2 pages. Research Products Development Dept., Technical Div., Pennsalt Chemicals Corp., Box 4388, Philadelphia 18, Pa.

Print No. Ins. 211 on Reader Service Card

Booklet on Flame Retardant Compounds With Many Dielectric Uses

Several stable and versatile organic chemical compounds with many applications as dielectric-coolant-insulation fluids in transformers and capacitors; adhesives; coatings; and secondary or extender plasticizers in resin formulations, etc., are described in a comprehensive booklet titled, "The Aroclor Compounds." It discusses 13 Aroclor products, each representing a series, and lists properties such as flame retardance, electrical resistivity, and stability toward heat, acids, alkalies, and oxidation. The compounds are a series of chlorinated biphenyls and polyphenyls ranging from oily fluids to crystalline powders. 43 pages. Organic Chemicals Div., Monsanto Chemical Co., 800 N. Lindbergh, St. Louis 66, Mo.

Print No. Ins. 212 on Reader Service Card

Polyurethane Bulletin

Revised Bulletin G-18 covers a new polyurethane material called "Estane." It presents data on three Estane polymers, one of which is expected to have major applications in the field of wire and cable jacketing. 16 pages. B. F. Goodrich Chemical Co., a division of The B. F. Goodrich Co., 3135 Euclid Ave., Cleveland 15, Ohio.

Print No. Ins. 213 on Reader Service Card

Revised 115-Page Reference Book On Laminated Plastics

The 1961 edition of "Formica Designer's Fact Book," a technical reference book on laminated plastics, has been completely revised. New edition contains property and application data covering 70 standard, special, and molding grades of high-pressure thermosetting laminating plastics, military specs, a grade comparator chart, tolerance and weight specifications, information on coast-to-coast fabricating facilities, district office listings, additional information and data, and many illustrations. 115 pages. Send name and title on company letterhead to Formica Corp., 4550 Spring Grove Ave., Cincinnati, Ohio.

Charts of Plastics' Properties

New bulletin contains three two-page charts of properties of thermoplastics, three two-page charts of thermosets, and one two-page chart of the properties of high pressure laminates. These charts list the name of the plastic down the lefthand edge and the characteristics along the top of each open spread. 16 pages. Commercial Plastics & Supply Corp., 630 Broadway, New York 12.

Print No. Ins. 214 on Reader Service Card

Publication on Bonding Silicone Rubber

Illustrated bulletin CDS-245 reviews the existing silicone rubber bonding technology and presents some of the latest advances and new techniques which help eliminate the more difficult bonding problems. The material covers five practical categories of bonding problems including: (1) bonding cured silicone rubber to cured silicone rubber, (2)
bonding cured silicone rubber
metal, (3) bonding cured silico
rubber to plastic, (4) bonding u
cured silicone rubber to cured silico
rubber, and (5) bonding uncur
silicone rubber to metal. The public
tion also includes data on typic
bond strengths of silicone rubber u
der a variety of conditions. 4 page
Silicone Products Dept., General El
tric Co., Waterford, N.Y.

Print No. Ins. 215 on Reader Service Card

Digest Reviews 94 Chemicals

Ninety-four organic and inorga
chemicals are concisely reviewed i
newly revised and enlarged qui
reference digest. Digest No. 100
gives useful factual information c
ering 88 commercially produc
chemicals and 6 development pr
ucts. Included are more than 20 n
or recently developed chemicals
thumbnail description, physical da
chemical formula, uses, and types a
weights of shipping containers
presented for all 94 chemicals list
16 pages. Hooker Chemical Cor
P. O. Box 344, Niagara Falls, N.Y.

Print No. Ins. 216 on Reader Service Card

Technical Report on a Polyester Laminate for Slot Insulation

A new technical report covers
polyester fiber non-woven mat/po
ester film laminate ("Dacron
"Mylar"-"Dacron") saturated w
epoxy resin for class B motor slot
sulation. It is said to be the o
available technical report on the pr
uct, called "Epoximat." It is availa
by letterhead request only. 14 pag
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Providence, R.I.

Resins Price List

New price list covers two types
polyester resins (monomer-free
styrene-thinned), two urethane fo
resins, and a copolymer alkyd re
1 page. Commercial Resins Corp.,
James Ave., St. Paul 2, Minn.

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Data Sheet on Strip Coating And Masking Wax

New data sheet describes use
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leads, lugs, contact points, and ot

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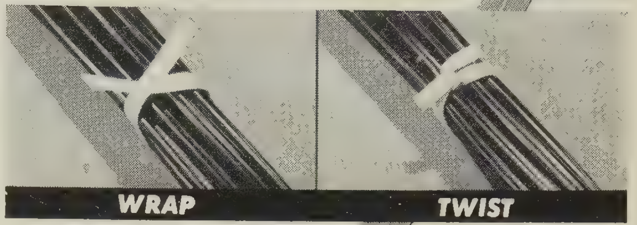

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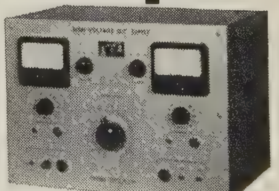

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component parts during casting, potting, dip-coating, or embedment with epoxy resin compounds. Method of application and typical properties are also given. 1 page. Isochem Resins Co., 221 Oak St., Providence 9, R.I.
Print No. Ins. 218 on Reader Service Card

Mica Technical Bulletin

First of a series of technical bulletins to be issued periodically, mica Technical Bulletin No. 1 contains technical data and answers to questions resulting from a mica association questionnaire. 2 pages. Mica Industry Association Inc., 420 Lexington Ave., New York 17.
Print No. Ins. 219 on Reader Service Card

Coil Brochure

New brochure describes and illustrates the advanced development of coils, facilities for making them, and the steps involved in solving problems encountered by manufacturers of relays, solenoids, and contactors. A block diagram illustrates the advantages of "Turbopower" coils and the solution to more ampere turns. Many coil types are illustrated. 4 pages. Tur-Bo Jet Products Co. Inc., 424 S. San Gabriel Blvd., San Gabriel, Cal.
Print No. Ins. 220 on Reader Service Card

Cable Connector Catalog

Complete technical data on the "Foamflex" series of coaxial cable connectors is contained in a new catalog. Also featured are connectors which are designed for applications involving "Spirafil" and "Styroflex" cables. 8 pages. Kings Electronics Co. Inc., 38 Marbledale Rd., Tuckahoe, N.Y.
Print No. Ins. 221 on Reader Service Card

Catalog of Dielectric Testers

New short form catalog #60 illustrates, describes, and lists pertinent data on hipot testers, overpotential testers, high voltage test sets, sparkers, continuity testers, corona test sets, cable fault locating sets, abrasion-scrape tester, and capacitor charging power supplies. 4 pages. Peschel Electronics Inc., Towners, R.F.D. 1, Patterson, N.Y.
Print No. Ins. 222 on Reader Service Card

Company History and Product Review

Technological and company history unfold side by side in a new file-size booklet, "From Kite and Key to Outer Space." It traces activities from the earliest basic applications of the company's solderless termination techniques to numerous advanced electronic components and gives the reader a capsulized review of the company, its facilities, products, and services. 20 pages. AMP Inc., Harrisburg, Pa.
Print No. Ins. 223 on Reader Service Card

Manual on Methods and Equipment For Testing Insulating Materials

A new manual covers methods and equipment for testing insulating materials. Some of the wide range of subjects included in manual G-65 are: high voltage breakdown testing of insulating materials in accord with ASTM specifications, automatic rate of rise control for high voltage breakdown testing of insulating materials, determining resistance to arcing of insulating materials, testing insulating oils for high voltage breakdown, detection of corona leakage in high voltage equipment, and high voltage breakdown testing of power cables and bushings. 39 pages. Associated Research Inc., 3777 W. Belmont Ave., Chicago 18.
Print No. Ins. 224 on Reader Service Card

Electron-Irradiation Literature

"Low-Cost Electrons: 'Dynamitron'—A High-Power Electron Accelerator," describes characteristics and operation of the Dynamitron accelerator, predicts electron-irradiation costs of $1/kwh. Copies available from Radiation Dynamics Inc., Westbury, L.I., N.Y.
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Bulletin on Wire Enameling Equipment

Bulletin #260 describes and illustrates a complete line of wire enameling equipment for the film coating of wires ranging in size from .0006 diameter to large rounds and rectangulars up to 85,000 square mils cross sectional area. Complete systems including all equipment required for the modern wire enameling plant are covered. Michigan Oven Co., 415 Brainard St., Detroit 1.
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Catalog of Electrical Testing And Measuring Instruments

New catalog SF-22 on testing a
measuring instruments contains s
eral new additions to a line of brid
type instruments including an imp
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instrument for measurement of R,
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measure capacitance and power fac
of insulating materials under hi
voltage stress, and three auto brid
that provide for component testi
at high-speed with excellent accura
Also, several dual-range instrume
have been added to a list of standa
dielectric testers. A price list is
cluded. 5 pages. Industrial Inst
ments Inc., 89 Commerce Ro
Cedar Grove, Essex County, N.J.
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Environmental Testing Data Broch

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sents details on 13 types of envir
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and simulate various conditions
altitude and humidity. In addit
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perature performance, specific h
of various substances, metal shr
age, low temperature refrigera
conversion fluids, temperature c
version, and temperature contr
Schematic diagrams and engineer
data on equipment are also gi
36 pages. Webber Manufacturing
Inc., P. O. Box 217, Indianapoli
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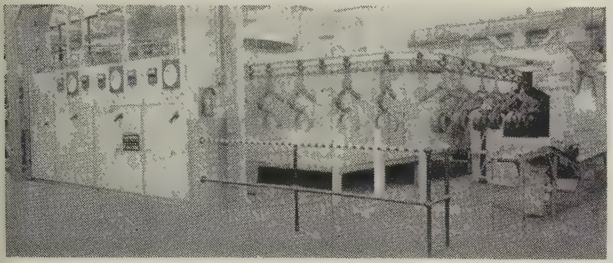

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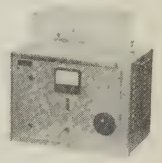

Model 4501 HYPOT Materials Tester. Meets D-149 etc., ASTM specifications.

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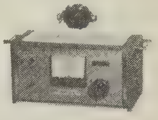

Model 4505 HYPOT Oil Tester provides 0-35 kv at 2 kva.

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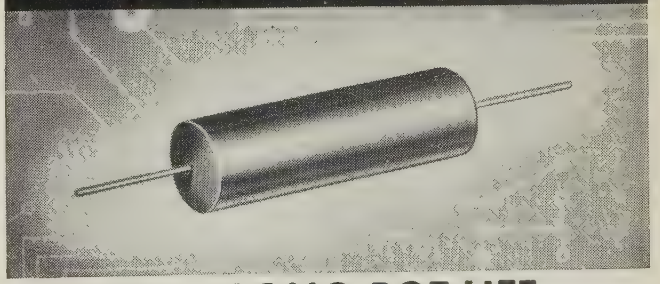

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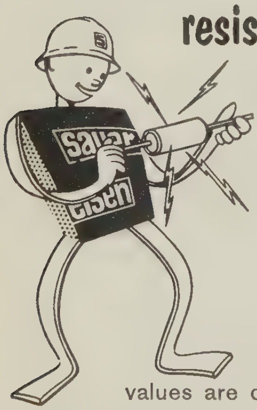

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Dates to Circle

Meeting and Convention Notices

Oct. 3-5 . . . IRE, Sixth National Communications Symposium, Hotel Utica and Utica Memorial Auditorium, Utica, N.Y.

Oct. 3-5 . . . IRE, Annual Meeting of the Professional Group on Nuclear Science, Gatlinburg, Tenn.

Oct. 3-7 . . . 21st Southern Textile Exposition, Textile Hall Corp., Textile Hall, Greenville, S.C.

Oct. 5 . . . SPE, Retec on "Plastics vs. Corrosion," sponsored by Golden Gate Section, Mark Hopkins Hotel, San Francisco, Cal.

Oct. 5-6 . . . EIA, Second Conference on Value Engineering, Disneyland Hotel, Anaheim, Cal.

Oct. 9-12 . . . ASME, Rubber and Plastics Conference, Lawrence Hotel, Erie, Pa.

Oct. 9-13 . . . Electrochemical Society Meeting, Shamrock Hilton Hotel, Houston, Tex.

Oct. 9-14 . . . AIEE, Fall General Meeting, Morrison Hotel, Chicago.

Oct. 10-12 . . . National Electronics Conference, sponsored by AIEE, IRE, and Illinois Institute of Technology, Hotel Sherman, Chicago.

Oct. 13-14 . . . SPI, 16th Annual New England Section Conference, Wentworth-by-the-Sea, Portsmouth, N.H.

Oct. 17-19 . . . Conference on Electrical Insulation, National Research Council—National Academy of Sciences, National Bureau of Standards and Shoreham Hotel, Washington, D.C.

Oct. 17-19 . . . International Congress on the Technology of Plastics Processing, Royal Institute for the Tropics, Amsterdam, Holland.

Oct. 19-21 . . . IRE, Symposium on Space Navigation, Deshler-Hilton Hotel, Columbus, Ohio.

Oct. 19-26 . . . International Plastics Exhibition "macroPlastic 1960," Croeselaan Exhibition Grounds, Utrecht, Holland.

Oct. 23-27 . . . National Electrical Contractors Assn., Convention and Expositi
Convention Hall, Las Vegas, Nev.

Oct. 24-26 . . . IRE, East Coast Conferen
on Aeronautics and Navigational El
tronics, Lord Baltimore Hotel, Baltimo
Md.

Oct. 25-27 . . . ASTM, 11th National C
ference on Standards, Sheraton-Atlan
Hotel, New York, N.Y.

Oct. 27-29 . . . IRE, Electron Devices Me
ing, Hotel Shoreham, Washington, D.

Oct. 31-Nov. 2 . . . IRE, Radio Fall Me
ing, Hotel Syracuse, Syracuse, N.Y.

Oct. 31-Nov. 4 . . . IEC, General Meeti
New Delhi, India.

Nov. 1-4 . . . ASTM Committee D-2
Electrical Insulating Liquids and Gas
Williamsburg Motor House, Willia
burg, Va.

Nov. 7 . . . AIEE, 2nd Western Applia
Technical Conference, Los Angeles S
tion, Biltmore Hotel, Los Angeles.

Nov. 7 . . . SPE, Retec on "Automatio
Injection and Compression Moldin
Ontario Section, King Edward Shera
Hotel, Toronto, Ontario, Canada.

Nov. 14-17 . . . The Wire Assn., Ann
Convention, La Salle Hotel, Chicago.

Nov. 15-15 . . . IRE, Mid-America E
tronics Convention, Hotel Muehleba
Kansas City, Mo.

Nov. 15-17 . . . IRE, Northeast Electro
Research and Engineering Meeting, B
ton, Mass.

Nov. 18 . . . SPE, Retec on "Blow Mold
Comes of Age," Newark Section, Es
House, Newark, N.J.

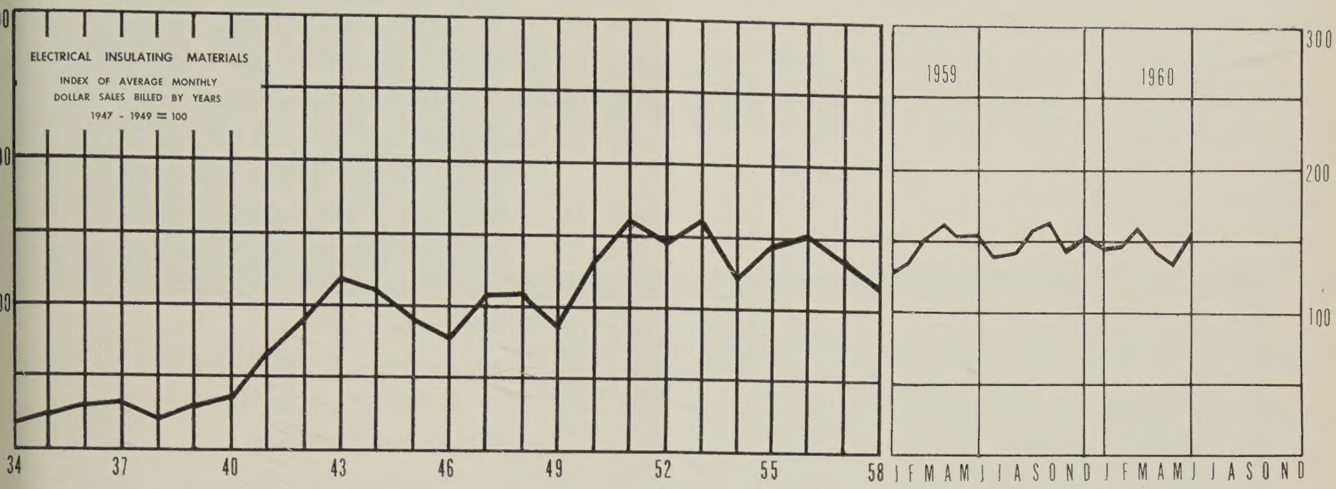
Nov. 30-Dec. 2 . . . Ninth Annual Sym
sium on Technical Progress in Commu
cation Wires and Cables, sponsored
The U. S. Army Signal Research and
velopment Laboratory, Berkeley-Cart
Hotel, Asbury Park, N.J.

Dec. 5-8 . . . Third National Conference
the Application of Electrical Insulati
Conrad Hilton Hotel, Chicago.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	NISA	—National Industrial Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	June '60	May '60	June '59
ndex Series	152	134	153
ne '60 point change from other mos.		+18	—1
ne '60 % change from other months		+13	—1

ndex is based on 1947-1949 average month, inclusive= 100

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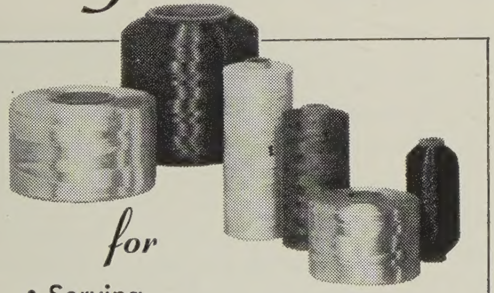

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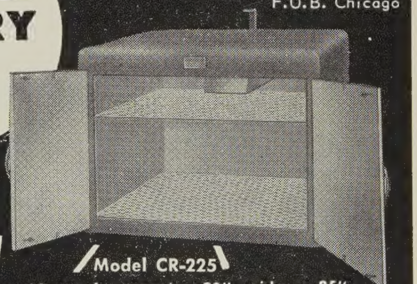

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Ins. 48	American Electrical Heater Co.	74
Ins. 26 & 27	American Enka Corp., Wm. Brand-Rex Div.	50 & 51
Ins. 17	Anaconda Wire & Cable Co.	37
Ins. 58	Associated Research, Inc.	83
Ins. 11	Atlas Asbestos Co.	27
Ins. 62	Belding Corticelli	85
Ins. 65	Bentley-Harris Manufacturing Co.	Outside Back Cover
Ins. 46	Coast Mfg. and Supply Co.	73
Ins. 34	Continental-Diamond Fibre Corp.	57
Ins. 20	Coors Porcelain Co.	42
Ins. 59	Cottrell Paper Co., Inc.	83
Ins. 45	Crocker, Burbank Papers Inc.	72
Ins. 56	Del Electronics Corp.	81
Ins. 13	J. P. Devine Mfg. Co.	33
Ins. 43	E. I. du Pont de Nemours & Co. (Inc.), Fabrics Div.	69
Ins. 32	The Electrical Refractories Co.	56
Ins. 8	Essex Wire Corp.	11
Ins. 7	The G. S. Equipment Co.	10
	General Electric Co.	
Ins. 64	Laminated Products Dept.	Inside Back Cover
Ins. 9 & 30	Silicone Products Dept.	17 & 54
Ins. 33	General Hermetic Sealing Corp.	56
Ins. 5	The Glastic Corp.	7
Ins. 55	J. J. Glenn and Co.	81
Ins. 47	Green Instrument Co., Inc.	74
Ins. 63	Grieve-Hendry Co., Inc.	85
Ins. 54	H. F. Hanscom & Co., Inc.	81
Ins. 37	Hess, Goldsmith & Co., Inc., Horace Linton Div.	59
Ins. 25	Hudson Wire Co., Ossining Div.	49
	Johns-Manville	
Ins. 52	Fiber Glass Div.	79
Ins. 12	Industrial Insulations Div.	28 & 29
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Ins. 16	Metalizing Industries, Inc.	3
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	Minnesota Mining & Manufacturing Co.	
Ins. 15	Electrical Products Div.	3
Ins. 2	Mica Insulator Div.	
Ins. 50	Mitchell Rand Manufacturing Co.	7
Ins. 19	Mosinee Paper Mills Co.	4
Ins. 53	Mystik Adhesive Products, Inc.	8
Ins. 22	National Conference on the Application of Electrical Insulation	4
Ins. 6	Natvar Corp.	
Ins. 1	Permacel	Inside Front Cove
Ins. 35	Peschel Electronics, Inc.	5
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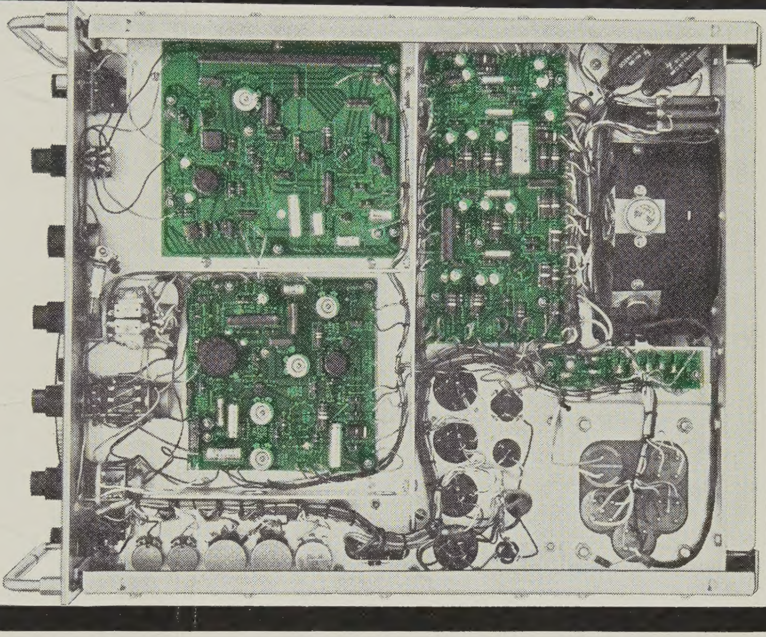
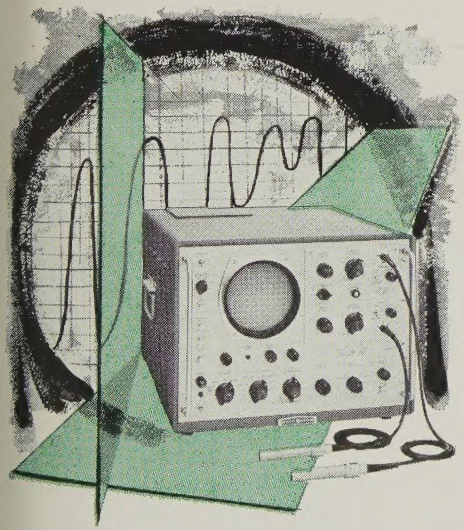


Photos of model 185A oscilloscope courtesy Hewlett-Packard Company

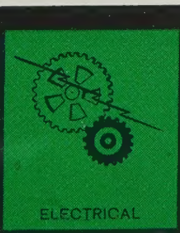


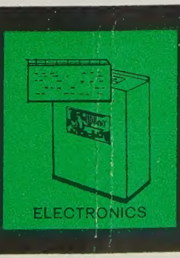
The Hewlett-Packard Company has developed a sampling oscilloscope that has a rise time of less than 0.7 millimicroseconds. Known as Model 185A, it is highly useful wherever pulse analysis of fast circuits can speed engineering, research, design, or performance testing.

Because of the extreme accuracy demanded of the 185A, etched circuits must be absolutely dependable. Base laminate requirements, according to Hewlett-Packard, were: "high bond strength, low water absorbtion and high insulation resistance". Tests proved the reliability of G-E Textolite 11558 copper-clad laminates for the application.

Easy-to-machine, 11558 is a NEMA G-10 glass-epoxy laminate available copper-clad on one or both sides. It combines extremely high mechanical strength with excellent electrical properties and resistance to moisture. G-E *engineered cleanliness* assures a smooth continuous copper surface.

For information on 11558 copper-clad or information on the complete line of Textolite laminates consult Sweet's Product Design File, Cat. 2b/Gen., or write: Laminated Products Department, Section I-100, General Electric Company, Coshocton, Ohio.





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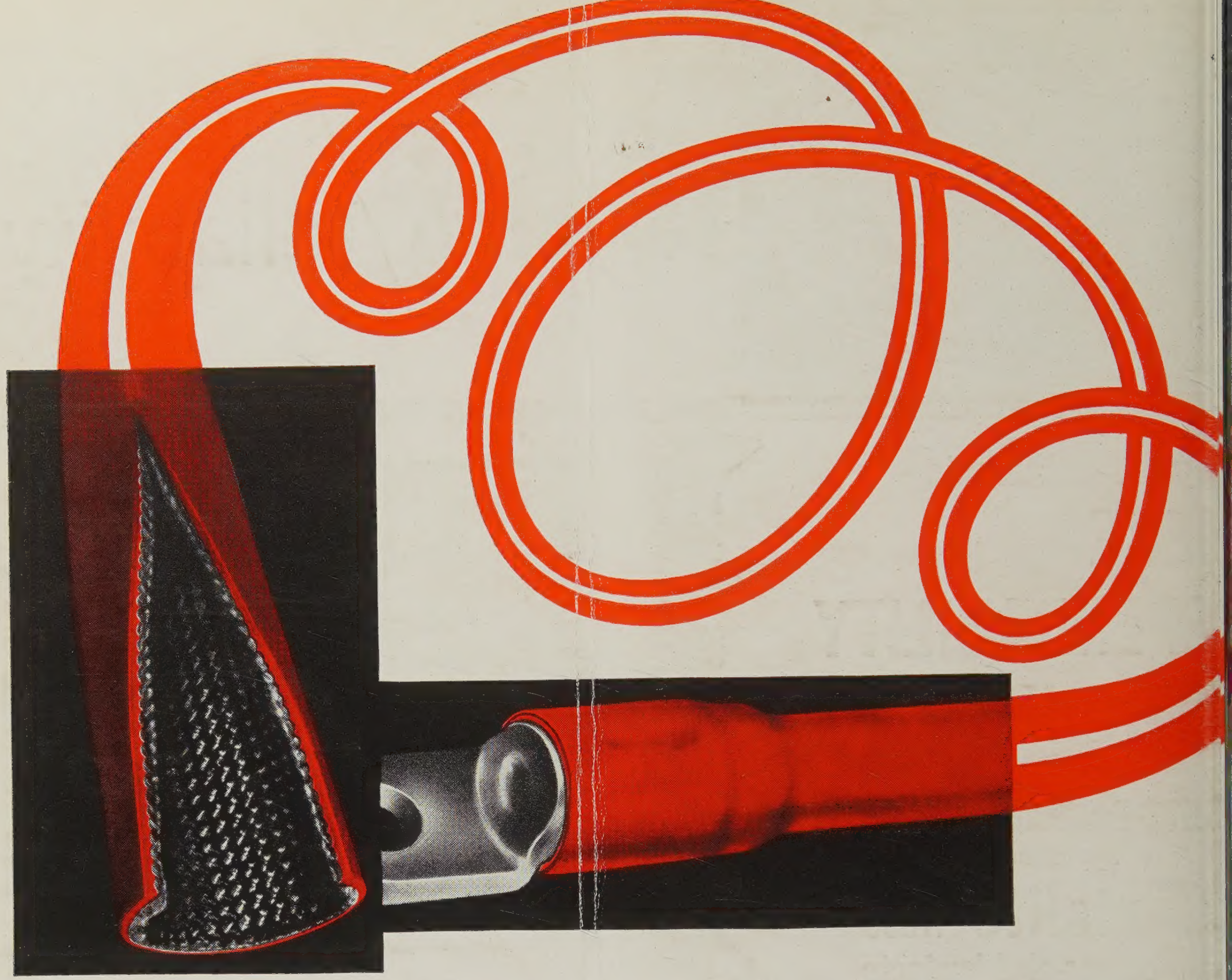

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Most useful when physical toughness is the key design factor.

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. . . Easy assembly and snug fit over irregular knobs, terminals and connectors.

. . . Electronically inspected guaranteeing precisely controlled dimensions and 100% dielectric reliability.

. . . Eliminates breakdown caused by pushback, abrasion or rough handling.

BEN-HAR "1258" durasyl Tubing

Most useful where maximum flexibility and efficient use of space are necessities.

. . . Offers self-fitting properties through dilation without affecting its superior dielectric and physical properties.

. . . 220°C. continuous operating temperatures. Permanent flexibility from —85°C. to 260°C.

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